PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2004-192977
(43)Date of publication of application : 08.07.2004

(51)Int.Cl. H05B 33/02
H05B 33/04
H05B 33/12
H05B 33/22
H05B 33/26

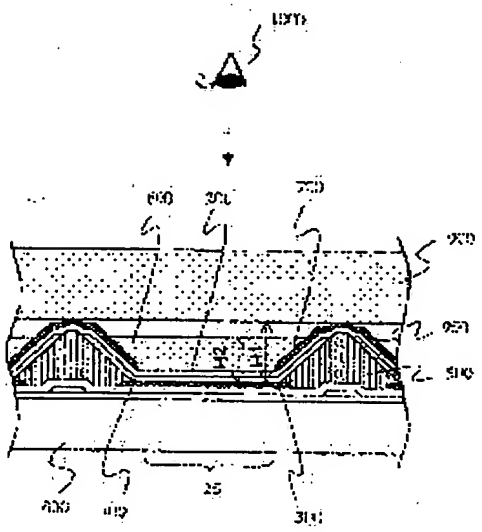
(21)Application number : 2002-360283
(22)Date of filing : 12.12.2002

(71)Applicant : HITACHI LTD
(72)Inventor : ADACHI MASAYA
TSUJI KAZUTAKA
MURAKAMI HAJIME
NISHIMURA ETSUKO

(54) LIGHT EMITTING ELEMENT AND DISPLAY DEVICE USING IT

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a light emitting type display device having high light extraction efficiency, and displaying a high-quality image without causing optical cross talk or blur in display.
SOLUTION: Projections 500 having tilting reflection surfaces 700 so as to surround luminescent regions are formed between pixels each having an organic film 100, a transparent electrode 200 and a reflection electrode 300 for forming the luminescent regions on a substrate 800; and transparent wave guide layers 600 are formed in the regions surrounded by the projections 500 in a form optically separated from one another on a pixel-by-pixel basis.

図 1



LEGAL STATUS

[Date of request for examination] 23.04.2004

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1]
It is the light emitting device which has the luminous layer of the shape of a flat field at least in a part,
The light emitting device characterized by having the inclination reflector which inclined to the flat part of said luminous layer in the periphery section of the flat part of this luminous layer at least, filling up the field which is on said luminous layer and is surrounded in this inclination reflector with the waveguide which guides light, and this lightguide being optically separated by the inclination reflector.
[Claim 2]
The light emitting device according to claim 1 characterized by the width of face of the cross-section configuration becoming large as said waveguide separates from the field which accomplishes the flat part of said luminous layer.
[Claim 3]
It is the display equipped with the light emitting device which constitutes two or more pixels arranged in the shape of a matrix on a substrate,
This light emitting device is a display characterized by being the light emitting device which has the luminous layer of the shape of a flat field at least in a part, having the inclination reflector which inclined to the flat part of said luminous layer in the periphery section of the flat part of this luminous layer at least, filling up the field which is on said luminous layer and is surrounded in this inclination reflector with the waveguide which guides light, and separating this waveguide optically for every pixel.
[Claim 4]
It is the display according to claim 3 which said inclination reflector is formed in the inclined plane of the projection formed on said substrate, and is characterized by the width of face of the cross-section configuration becoming small as this projection separates from said substrate side.
[Claim 5]
Said waveguide is a display according to claim 3 which has the cross-section configuration to which width of face becomes large as it separates from said substrate side, and is characterized by the height from the flat part of said luminous layer of said inclination reflector being higher than the maximum height of said waveguide.
[Claim 6]
The display according to claim 3 characterized by being formed after said waveguide has dissociated for every pixel.
[Claim 7]
The display according to claim 3 characterized by for the height from the flat part of said luminous layer of said waveguide serving as min in the core of the field surrounded by said inclination reflector, and becoming so high that said inclination reflector being approached.
[Claim 8]
The display according to claim 3 characterized by the height from the flat part of said luminous layer of said waveguide serving as max in the core of the field surrounded by said inclination reflector.
[Claim 9]
The display according to claim 3 characterized by being the organic light emitting diode which carried out the laminating of the reflector on which said light emitting device functions as a light reflex side from said substrate side, the luminous layer which consists of organic film, and the transparent electrode.
[Claim 10]
The display according to claim 9 characterized by the refractive index of said waveguide being higher than

air, and being lower than said transparent electrode.
[Claim 11]
The display according to claim 9 characterized by for said inclination reflector consisting of conductive film, and connecting with said transparent electrode electrically.
[Claim 12]
The display according to claim 9 which said inclination reflector consists of conductive film, and is electrically connected with said reflector, or is characterized by having the function of said reflector.
[Claim 13]
The display according to claim 9 characterized by pasting up said substrate and said closure member where it was transparent, it has arranged the closure member which has gas barrier property to the luminous layer forming face side of said substrate to the light and the gap of the same refractive index as air is substantially prepared between this closure member and said waveguide.
[Claim 14]
The display according to claim 4 characterized by having the projection which divides a pixel into two or more fields, and equipping the inclined plane of this projection with an inclination reflector.
[Claim 15]
The display according to claim 14 characterized by forming the projection which divides said pixel into two or more fields on said reflector.
[Claim 16]
Said waveguide is a display according to claim 9 characterized by consisting of transparent inorganic film by which the part has gas barrier property.
[Claim 17]
The display according to claim 9 characterized by carrying out mixing distribution of the pigment at said waveguide.
[Claim 18]
The display according to claim 8 characterized by having the color conversion layer which turns into said waveguide from the fluorochrome which changes a blue light into the light of green or red.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]
About the display which displays by controlling luminescence actuation of a light emitting device and a light emitting device, especially, this invention is used for light emitting devices, such as organic light emitting diode, and a display equipped with this, and relates to an effective technique.
[0002]
[Description of the Prior Art]
Organic light emitting diode (hereafter referred to as OLED (Organic Light-Emitting Diode)) is a component which transforms electrical energy into light energy and emits light by pouring forward negative charge into the luminous layer which consists of an organic thin film. indicating equipment (it is hereafter called an OLED display) which consists of OLED(s) a thin shape since it is a spontaneous light type unlike the indicating equipment of the nonluminescent mold represented by the liquid crystal display and the sources of a fill-in flash, such as a back light, are unnecessary -- it is lightweight. An OLED display has a still larger angle of visibility, and it has the description that the speed of response of a display is early.
[0003]
Drawing 33 is an important section outline sectional view explaining an example and the display action of the structure of the conventional OLED. This OLED has structure which carried out the laminating of the transparent electrode 200 which functions on the transparence substrate 400 as an anode plate, the hole transportation layer 103, a luminous layer 102, the electronic transportation layer 101, and the reflector 300 that consists of a metal of light-reflex nature which functions as cathode one by one. If direct current voltage is impressed between a transparent electrode 200 and a reflector 300, each will reach [the electron with which the hole poured in from the transparent electrode 200 was poured in from the reflector 300 via the hole transportation layer 103] a luminous layer 102 via the electronic transportation layer 101, the recombination of an electronic-hole will arise, and luminescence of predetermined wavelength will arise from here. A part of light which carries out outgoing radiation from a luminous layer 102 passes the transparence substrate 400, and it is observed by the observer 1000. under the present circumstances, the case of the structure which carried out the laminating of the flat layer in parallel as shown in drawing 33 -- a laminating side -- abbreviation -- in order for the light with whenever [incident angle / of light / larger] than a critical angle to guide waves in the direction parallel to a laminating side and not to carry out outgoing radiation to an observer side in the light which carries out outgoing radiation in the parallel direction, and the interface of each class, it is not effectively used as a display light.
[0004] general -- optical ejection effectiveness (ratio of the quantity of light taken out from a component by observer side 1000 to the amount of luminescence which carries out outgoing radiation from a luminous layer) -- a classic -- the optical estimate says about 20%, many of light which carried out outgoing radiation from the luminous layer guides waves in the direction parallel to a laminating side, and it is lost. For this reason, in order to realize a bright OLED display with a low power, it is important to reduce guided wave loss and to improve optical ejection effectiveness.
[0005]
In order to reduce guided wave loss, OLED which established the reflector of the electrode which has a slant face is indicated by "the patent reference 1" and the "patent reference 2." In this case, it is indicated that it reflects in the sloping reflector, guided wave loss is controlled in order for the travelling direction of light to change and to carry out outgoing radiation to an observer side, and effectiveness of light which progresses in parallel or the almost parallel direction among the light which carried out outgoing radiation from the

luminous layer at a substrate side or a laminating film surface improves.
[0006]
[Patent reference 1]
JP,2001-332388,A
[Patent reference 2]
** table 2001-No. 507503 official report.
[0007]
[Problem(s) to be Solved by the Invention]
Drawing 34 is the important section outline sectional view showing an example of the conventional OLED. In drawing 34 , among the light which carried out outgoing radiation from the organic film 100 containing a luminous layer, it reflects in the sloping reflector (drawing inclined plane of an electrode 300), and a part of light which carries out outgoing radiation to a substrate side in parallel or the almost parallel direction changes the travelling direction, and it carries out outgoing radiation to an observer 1000 side. However, since it is restricted to a part of light which carried out outgoing radiation from the luminous layer, much light loses the light which carries out incidence to the reflector which carried out outgoing radiation and inclined from the luminous layer by the guided wave, and it is not still used effectively. Furthermore, a blot of an optical cross talk and a display occurs by reflecting in the inclination reflector which guided waves to the pixel from which a part of light which does not carry out incidence differs, and was formed in the inclination reflector at a different pixel among the light which carried out outgoing radiation from the luminous layer of a certain pixel, and turning on an observer. Moreover, as shown in drawing 34 , in using the sloping reflector also [electrode / which constitutes OLED], it disconnects for the level difference in the part into which an electrode layer overcomes an inclined plane, and is easy to generate a defect.
[0008]
The purpose of this invention is to solve the above-mentioned various technical problems of OLED, and it is to offer the display of the luminescence mold which displays a high-definition image without a blot of an optical cross talk and a display at the same time it realizes a bright display by making the light which carried out outgoing radiation from the luminous layer contribute to a display efficiently. Moreover, even if other purposes of this invention form the reflector which carried out [above-mentioned] the inclination, they are to offer OLED without generating of the defect by open circuit of an electrode. About the purpose of further others of this invention, it will become clear from the following description.
[0009]
[Means for Solving the Problem]
In order to attain the above-mentioned purpose, the display of this invention It is the display equipped with the light emitting device which constitutes two or more pixels arranged in the shape of a matrix on a substrate. This light emitting device is a light emitting device which has the luminous layer of the shape of a flat field at least in a part. It has the reflector (inclination reflector) which inclined to the flat part of said luminous layer in the periphery section of the flat part of this luminous layer at least. The field which is on said luminous layer and is surrounded in this inclination reflector shall be filled up with the waveguide which guides light, and it shall have the description at the point that this waveguide is optically separated for every pixel. Moreover, said inclination reflector is formed in the inclined plane of the projection formed on said substrate, and this projection shall have the cross-section configuration to which the width of face becomes small as it separates from said substrate side. For this reason, said waveguide has the cross-section configuration to which width of face becomes large as it separates from said substrate side.
[0010]
Moreover, in order to realize the waveguide optically separated for every above-mentioned pixel, the height from the flat part of said luminous layer of said inclination reflector is made higher than the maximum height of said waveguide. Or this waveguide is formed in the condition of having dissociated for every pixel.
[0011]
The organic light emitting diode of the structure which carried out the laminating of the reflector which functions as a light reflex side as said light emitting device, the luminous layer which consists of organic film, and the transparent electrode can be used. Under the present circumstances, the refractive index of a waveguide is higher than air, and it is desirable to constitute from the transparent body with a refractive index lower than said transparent electrode.
Moreover, to the light, it is transparent, and the closure member which has gas barrier property is arranged to the luminous layer forming face side of said substrate, and where the gap of the same refractive index as

air is substantially prepared between this closure member and said waveguide, said substrate and said closure member are pasted up.

[0012]

In the display of the above-mentioned configuration, after reflecting with remaining as it is or a reflector, the light which carries out outgoing radiation from a luminous layer passes a transparent electrode, and it carries out incidence to a waveguide. Although the light which carries out incidence at an include angle smaller than a critical angle reflects a part in the interface (front face of the following and a waveguide) of a waveguide and a gap among the light which carried out incidence to the waveguide, much light passes a gap and a closure member, and goes to an observer side as an image light. Total reflection of the light which carries out incidence to the front face of a waveguide at a bigger include angle than a critical angle on the other hand among the light which carried out incidence to the waveguide is carried out on the surface of a waveguide, and it guides the inside of a waveguide in the direction parallel to a substrate side. If the light which guides the inside of a waveguide reaches an inclination reflector soon, the travelling direction of light changes by reflecting there and incidence is carried out at an include angle smaller than a critical angle on the surface of a waveguide, a part will carry out outgoing radiation and will be effectively used for an observer side as an image light.

[0013]

That is, since waves are guided in the direction parallel to a substrate side, the light which had been lost is efficiently led to an inclination reflector by the waveguide, the travelling direction of the light changes by reflection in an inclination reflector and it can use effectively as an image light conventionally, optical ejection effectiveness improves. Under the present circumstances, since it dissociates completely for every pixel, and the light which carried out outgoing radiation from the luminous layer of a certain pixel does not guide waves to a different pixel from this, a waveguide can realize the high-definition display without degradation of the image quality of an optical cross talk and an optical blot.

[0014]

[Embodiment of the Invention]

Hereafter, the gestalt of operation of this invention is explained to a detail with reference to the drawing of an example. The important section outline sectional view near [where drawing 1 explains one example of the display by this invention] 1 pixel, and drawing 2 are the important section top views explaining one example of the display by this invention. And drawing 1 is equivalent to the cross section which met the A-A line of drawing 2 . Moreover, it juxtaposes in drawing 2 , and one color of 1 pixel is constituted from three pixels which consist of red luminescence pixel 20R [which was shown], green luminescence pixel 20G, and blue luminescence pixel 20B, and a color predetermined by carrying out the additive mixture of colors of the light of each color in which these three pixels emit light is displayed. In addition, these pixels 20R, 20G, and 20B are also called a unit pixel or a sub-picture element, and, in the case of monochrome display equipment, a unit pixel serves as 1 pixel of monochrome.

[0015]

Moreover, the reflector 300 which consists of the electrical conducting material of light reflex nature on the substrate 800 with which the insulating layer prepared according to wiring, the switching element, the part by volume, and the need of not illustrating [in which the indicating equipment of this invention is formed if needed] was formed is formed in island shape corresponding to a pixel, and the projection 500 which it becomes from an insulating ingredient so that the edge of a reflector 300 may be covered in the periphery section of a reflector 300 is formed. This projection 500 is carrying out the cross-section configuration to which that width of face becomes narrow as it separates from a substrate 800, and it has an inclined plane on a side face. A part of inclined plane of projection 500, and on a reflector 300, it has the organic layer 100 containing the luminous layer formed in island shape for every pixel, and the transparent electrode 200 which consists of an electrical conducting material of light transmission nature is further formed on these.

[0016]

A transparent electrode 200 and a reflector 300 function as an anode plate (or cathode) and cathode (or anode plate), respectively, and constitute organic light emitting diode with the organic layer 100 formed in inter-electrode [these]. The three-tiered structure to which the organic layer 100 carried out the laminating of an electronic transportation layer, a luminous layer, and the hole transportation layer to order from the cathode side, or a luminous layer and an electronic transportation layer can use the two-layer structure made into one layer by using the ingredient which can be made to serve a double purpose. Moreover, as structure of an organic light emitting diode, what has arranged the anode plate buffer layer may be further used between an anode plate and a hole transportation layer.

[0017] It is on a transparent electrode 200, and the inclination reflector 700 which consists of a metal of light reflex nature is formed in the location equivalent to the inclined plane of projection 500, and it is transparent and fills [as opposed to / in the field of the shape of a depressed ground surrounded further at the projection 500 700, i.e., an inclination reflector, / the light] up with the waveguide 600 by which the refractive index is constituted from air with a large ingredient. In addition, since an organic layer 100 deteriorates with the moisture in atmospheric air etc., it is usually desirable to carry out sealing closure using a closure means so that it cannot touch with the open air. Here, by using projection 500 as a spacer, to the light, it is transparent and the case where it fixes by the sealing compound with the adhesive property which applied to the perimeter of the display of a display the closure member 900 which has gas barrier property, and the substrate 800 in the shape of a frame is shown.

[0018]

As a closure member 900, a glass plate, the thing which carried out the laminating of the resin film which performed gas barrier processing, and a thin glass plate and a resin film can be used. Under the present circumstances, between the closure member 900 and a waveguide 600, it is important to form the gap 950 of a refractive index comparable as air. This is because a cross talk and the problem of a blot will be caused by carrying out outgoing radiation from an organic layer 100, and carrying out incidence to the closure member 900 from this contact section, and not carrying out outgoing radiation to an observer 1000 side by guiding the inside of the closure member 900, but being lost, or the light which guides a waveguide 600 carrying out incidence to another pixel through the closure member 900, and carrying out outgoing radiation from there to an observer 1000 side if the closure member 900 and the waveguide 600 touch.

[0019]

What is necessary is for it to be good to enclose a gas with inactive nitrogen gas etc. with a gap 950, and to enclose nitrogen gas and just to realize by carrying out sealing adhesion, in case the closure member 900 and a substrate 800 are fixed. Moreover, forming a gap 950 prepares the gap beyond the distance in which light is not desirably transmitted from a waveguide 600 to the closure member 900 according to the tunneling phenomenon of a photon, although it means that the waveguide 600 and the closure member 900 do not touch. Since the tunneling phenomenon of a photon is produced at leisure rather than wavelength for a short time, if there are 1 micrometers or more of gaps 950, they are enough.

[0020]

In addition, it is important for the height H2 of the waveguide 600 from a reflector 300 to make it lower than the height H1 of the inclination reflector 700 the height from the field which accomplishes the flat part 25 of organic light emitting diode, and here. It is because it will become the cause of a blot of an optical cross talk or a display by carrying out outgoing radiation from an organic layer 100, guiding waves to the pixel from which the light which guides a waveguide 600 differs across the inclination reflector 700, and carrying out outgoing radiation from there to the exterior if the reason has a waveguide 600 higher than the inclination reflector 700. It is because the closure member 900 will contact a waveguide 600 if it is not H1>H2 at least when arranging the closure member 900 flat as a spacer, projection 500 is originated in the light which invades into the closure member 900 from a waveguide 600 in this contact section and problems, such as decline in optical ejection effectiveness, and a cross talk and a blot, are furthermore produced.

[0021]

Drawing 3 is an important section outline sectional view for explaining an example of actuation of one example of the display by this invention. When a direct current according to a picture signal is passed between a transparent electrode 200 and a reflector 300, via an electronic transportation layer, the electron with which the hole poured in from the anode plate was poured in from cathode via the hole transportation layer reaches a luminous layer, and each is an electron. - The recombination of a hole arises and luminescence of predetermined wavelength arises from here. After reflecting with remaining as it is or a reflector 300, the light which carries out outgoing radiation from the luminous layer which constitutes an organic layer 100 passes a transparent electrode 200, and it carries out incidence to a waveguide 600. Although the light which carries out incidence at an include angle smaller than a critical angle reflects a part in the interface (it is hereafter called the front face of a waveguide) of a waveguide 600 and a gap 950 among the light which carried out incidence to the waveguide 600, much light passes a gap 950 and the closure member 900 which is not illustrated, and it carries out outgoing radiation and it can use it for an observer side as an image light 2000.

[0022]

Total reflection of the light which carries out incidence to the front face of a waveguide 600 at a bigger include angle than a critical angle on the other hand among the light which carried out incidence to the

waveguide 600 is carried out on the front face of a waveguide 600, and it guides the inside of a waveguide 600 in the direction parallel to the 800th page of a substrate. If the light which guides the inside of a waveguide 600 reaches the inclination reflector 700 soon, the travelling direction of light changes by reflecting there and incidence is carried out to the front face of a waveguide 600 at an include angle smaller than a critical angle, a part of light will carry out outgoing radiation, and will come to be effectively used for an observer side as an image light 2001. That is, since waves are guided in the direction parallel to the 800th page of a substrate, the light which had been lost is efficiently led to the inclination reflector 700 by the waveguide 600, the travelling direction of the light changes by reflection in the inclination reflector 700 and it can use effectively as an image light conventionally, optical ejection effectiveness improves. Under the present circumstances, since it dissociates completely for every pixel, and the light which carried out outgoing radiation from the organic layer of a certain pixel does not necessarily guide waves to a different pixel from this, a waveguide 600 produces neither an optical cross talk nor the problem of a blot of a display.

[0023]

In addition, the improvement in the optical ejection effectiveness by control of the optical loss resulting from a guided wave becomes so high that the thickness (height) of a waveguide 600 is large to luminescence area size. That is, in the case of the pixel structure illustrated to drawing 1 and drawing 2 , the flat part 25 surrounded by the projection 500 serves as a luminescence field, but to this luminescence area size, optical ejection effectiveness becomes high, so that a waveguide 600 is thick. This is based on the following reasons.

[0024]

The light which guides a waveguide 600 goes to the inclination reflector 700, mainly repeating reflection between the front face of a waveguide 600, and a reflector 300. Under the present circumstances, since the reflection factor of a reflector 300 is not usually 100%, whenever it reflects with a reflector, a part of light is absorbed by the reflector, and it is lost. Therefore, if it is made for the count which will be reflected with a reflector 300 by the time the light which guides a waveguide 600 reaches the inclination reflector 700 by enlarging relative thickness of the waveguide 600 to the magnitude, i.e., the luminescence area size, of a reflector to decrease, since loss of the light by the reflector 300 decreases, optical ejection effectiveness will become high. In addition, if a waveguide cannot guide light, it needs to be the thickness in which optical thickness of a waveguide is carried out more greatly than the wavelength of light since the effectiveness of the improvement in optical ejection effectiveness is not acquired, and the good guided wave of light is performed. For this reason, a certain thing of the thickness of a waveguide is desirable 1 micrometers or more.

[0025]

Like the pixel structure illustrated to drawing 2 , to longitudinal-direction die-length W on the space of a luminescence field, if vertical direction die-length H is long, the relation of > (H2/W) (H2/H) will be realized between the ratios of the die length of these luminescence field, and the height (thickness) H2 of a waveguide 600. In this case, the optical ejection effectiveness of a longitudinal direction becomes high rather than the above-mentioned reason to the vertical direction, and, as for the angle of visibility of brightness, a longitudinal direction becomes large rather than the vertical direction. This is effective when distributing a limited light to an observer side efficiently, that it is usually desired in a display for the angle of visibility of a longitudinal direction to be larger than the vertical direction, and. That is, on the conventional OLED display, there is no direction dependency in the angle-of-visibility property of brightness, it can cross to an omnidirection and the angle-of-visibility dependency of brightness can be controlled by controlling the ratio of the die length of a luminescence field, and the thickness of a waveguide which can set luminescence area size, i.e., the target direction, by this invention to having been equal. For this reason, it is possible to realize the optimal brightness property according to the application of a display.

[0026]

Apart from this, the angle-of-visibility property of brightness is [whenever / tilt-angle / of the inclination reflector 600 over the field (substrate side) which accomplishes a flat part 25] controllable also by alpha with this invention. Drawing 4 is an explanatory view by the graph which shows the result of having estimated the relation of the angle-of-visibility property of alpha and brightness whenever [tilt-angle]. The ratio of die-length W (refer to drawing 2) of a luminescence field to the direction to which its attention is paid, and the thickness H2 (refer to drawing 1) of a waveguide 600 is H2/W=0.1, and drawing 4 is the result of estimating the case where the refractive index of a waveguide is 1.5, with a 2-dimensional model. The

axis of abscissa of drawing 4 shows an angle of visibility, and an axis of ordinate shows the relative luminance standardized conventionally carried out the laminating of the flat layer in parallel by the transverse-plane brightness (brightness with an angle of visibility of 0 degree) of OLED of structure. According to this estimate, the viewing-angle property of brightness is changeable by changing the include angle alpha of an inclination reflector as illustration. For example, if alpha= 23 degrees - 30 degrees, the property that the brightness of the direction of a transverse plane and its near serves as a high angle-of-visibility property, and becomes with almost fixed brightness over the large angle-of-visibility range in the case of alpha= 45 degrees will be acquired, and at alpha= 60 degrees, if the angle of visibility of 50 degrees is exceeded, brightness will serve as the angle-of-visibility property of falling rapidly.

[0027]

Since the configuration of an inclination reflector does not serve as a slant face which consists of perfect flat surfaces actually, whenever [tilt-angle], alpha does not become a fixed include angle but the include angle will change with locations continuously. Therefore, the size of an angle of visibility is not required, but when it is desired for the brightness of the direction of a transverse plane to be high, it is made for the average of alpha to become 20 degrees - 30 degrees whenever [tilt-angle] rather like the display of the pocket electronic equipment which an individual mainly uses. it is desirable that a bright image is obtained in the large angle-of-visibility range as the average of alpha becomes with the include angle near 45 degrees whenever [tilt-angle] in the case of the display which there is many brightness of the direction of a transverse plane like [it is desirable and] television by making it become higher than the direction of slant, and is used. In addition, it is thought that it is not applicable to quantitive decision since it is as a result of [under the limited prerequisite in a 2-dimensional simple system] count, but this estimated result is effective when judging size relation qualitatively.

[0028]

Next, the relation of the refractive index of a waveguide 600 and a transparent electrode 200 is explained. Drawing 5 and drawing 6 are drawings for explaining the difference in the effectiveness by the size relation of the refractive index of a waveguide 600 and a transparent electrode 200, and drawing 5 shows the case where the refractive index of drawing 6 of a waveguide is larger than a transparent electrode, when the refractive index of a waveguide is smaller than the refractive index of a transparent electrode. Here, if the incident angle of the light which carries out incidence of the refractive index of n1 and a waveguide 600 for the refractive index of a transparent electrode to a waveguide is set to theta 1 from n2 and a transparent electrode and angle of refraction is set to theta 2, relation called sin theta1/sintheta2=n2/n1 will consist of a Snell's law. Therefore, when the refractive index n1 of a waveguide 600 is smaller than the refractive index n2 of a transparent electrode, angle of refraction theta 2 becomes larger than the incident angle theta 1.

[0029]

On the other hand, when the refractive index n1 of a waveguide 600 is larger than the refractive index n2 of a transparent electrode, angle of refraction theta 2 becomes smaller than the incident angle theta 1. For this reason, about the distance which guides waves, without reflecting the inside of a waveguide 600 on the surface of a waveguide, if the case of L1 and n1<n2 is set to L2 for the case of n1>n2, L1 will become longer than L2. I hear that the count which will be reflected with a reflector 300 by the time the light which guides the inside of a waveguide 600 reaches the inclination reflector 700 decreases, and loss of the light by absorption with a reflector becomes small, and the distance which guides waves, without the light which guides the inside of a waveguide 600 reflecting on the surface of a waveguide is sometimes long. For this reason, it is desirable when making the refractive index of a waveguide smaller than the refractive index of a transparent electrode improves optical ejection effectiveness. In addition, in the case of n1>n2, a critical angle exists between a transparent electrode 200 and a waveguide 600, total reflection of the light which carries out incidence from a transparent electrode at a bigger include angle than a critical angle to a waveguide cannot be carried out, and it cannot be led to a waveguide 600.

[0030]

On the other hand, in the case of n1<n2, since there is no critical angle, even if it is the light of whenever [incident angle / which becomes with a critical angle in the case of n1>n2], it can lead to a waveguide 600. However, since total reflection also of the light of such an incident angle is carried out on the front face of a waveguide 600 and it returns to a reflector 300 side after all, it is lost by repeating the front face of a waveguide 600, and reflection with a reflector 300 repeatedly. It is necessary to reduce the count which will be reflected with a reflector 300 by the time the light which makes a waveguide thicker and guides the inside of a waveguide reaches the inclination reflector 700, in order to prevent this. However, generally, since the refractive index of a transparent electrode 200 requires time amount for forming, without giving a

damage to the organic film etc. at the thickness of micron order of a transparent ingredient with a refractive index it is as high as about 1.8 to 2.2, and higher than this (for example, titanium oxide), it is not industrially desirable. Therefore, the refractive index of a waveguide is higher than air, and it is desirable to use a transparence resin ingredient with comparatively easy thick-film formation lower than a transparent electrode. In this case, as for the refractive index of a waveguide, it is realistic to be referred to as 1.3 to 1.7.
[0031]
Next, it explains, referring to a drawing about the example of a display. Drawing 7 is the block diagram showing typically the whole one example layout of the indicating equipment by this invention. Moreover, drawing 8 is the representative circuit schematic of the active matrix constituted by the display of drawing 7 . it is shown in drawing 7 -- as -- a display 1 -- the substrate 800 -- it has a display 2 in the center section mostly. The data drive circuit 3 which outputs a picture signal to the data line 7 is installed in this display 2 bottom (on drawing 7), and the scan drive circuit 4 which outputs a scan signal to the left-hand side of drawing to the gate line 8 is installed. These drive circuits 3 and 4 consist of a shift register circuit which consists of complementary circuits by TFT (Thin Film Transistor) of a P channel mold and an N channel mold, a level-shifter circuit, an analog switch circuit, etc. In addition, 9 is common potential wiring.
[0032]
In this indicating equipment 1, two or more gate lines and two or more data lines which made it extend in the direction which crosses to the extension direction of this gate line are formed on a substrate 800 like the liquid crystal display of a active-matrix mold, and as shown in drawing 8 , a pixel 20 is arranged in the shape of a matrix at the crossing place of those gate lines G1, G2, ..., Gm and data lines D1, D2, ..., Dn. The light emitting device 24 by which each pixel is constituted from OLED, and storage capacitance 23, The switch transistor 21 which consists of TFT of the N channel mold by which a gate electrode connects with a gate line, one side of a source drain electrode is connected to the data line, and another side is connected to storage capacitance 23, A gate electrode connects with this storage capacitance 23, and a source electrode is connected to the common potential wiring 9 which extends in the same direction as the above-mentioned data line. It consists of driver transistors 22 which consist of TFT of the N channel mold by which the drain electrode is connected to the cathode of OLED which constitutes a light emitting device 24. Moreover, it connects with a current supply source line common to all pixels, and the anode plate of OLED which constitutes a light emitting device 24 is maintained at the fixed potential Va. As a light emitting device 24, red and the thing which emits one of green and blue light are arranged in the shape of a matrix in predetermined sequence.
[0033]
According to the above-mentioned configuration, if the switch transistor 21 is turned on with a scan signal, a picture signal will be written in storage capacitance 23 through the switch transistor 21 from the data line. Therefore, the gate electrode of the driver transistor 22 is held at the potential which is equivalent to a picture signal with storage capacitance 23, even if the switch transistor 21 is turned off. The driver transistor 22 is continuously maintained at the drive condition in the grounded source mode in which it excels in constant current nature, and since it flows the organic light emitting diode with which the current from a current supply source line constitutes a light emitting device 24, it is maintained by the luminescence condition. It depends for the luminescence brightness at this time on the data written in storage capacitance 23. A halt of luminescence is realized by making the driver transistor 22 into an OFF state.
[0034]
Next, the structure of the display applied to one example of this invention with reference to drawing 9 , drawing 10 , and drawing 1 and drawing 2 is explained. Drawing 9 is the important section this abbreviation perspective drawing of the planar structure of the pixel in one example of the display by this invention. Moreover, drawing 10 is the sectional view which met the B-B line of drawing 9 . The gate line connected to driver elements (here thin film transistor), such as a switch transistor and a driver transistor, and these driver elements, the data line, common potential wiring, the electrode for storage capacitance, etc. are formed on the substrate 800 with flat glass etc., and, as for the indicating equipment of this example, the insulating layer 30 is formed in the upper layer. The reflector 300 which functions as cathode of a light emitting device 24 on an insulator layer 30 is formed in island shape, and a reflector 300 is connected with the drain electrode 26 of a driver transistor through the contact hole 31 of an insulating layer 30.
[0035]
In this example, a reflector 300 functions as cathode. As cathode, they are low aluminum of a work function, Mg, and Mg-Ag. An alloy, an aluminum-Li alloy, etc. can be used. In aluminum simple substance, since driver voltage is high and the life is short, what acquired the property which inserts very thin Li compounds

(lithium oxide Li2 O, lithium fluoride LiF, etc.) between the organic layers formed on a reflector, and is equal to an aluminum-Li alloy may be used. Moreover, the organic layer of the part which touches cathode is doped with reactant high metals, such as a lithium and SUTORINCHIUMU, and it may be made to make driver voltage low. In addition, as for a reflector, it is desirable to consist of ingredients with the high reflection factor of light from the field of the improvement in use effectiveness of light which carried out outgoing radiation from the organic layer.

[0036] the field in which a driver element and wiring were formed -- these -- covering -- in addition -- and projection 500 is formed so that the flat part of a reflector 300 may be surrounded. Under the present circumstances, in other words, projection 500 has the desirable thing which form so that a contact hole 31 may be covered and which is constituted so that a contact hole may be arranged at the lower part of a projection. It is because a level difference exists in the upper part of a contact hole 31, and this cannot be substantially used as a luminescence field, so it is effective in securing as large a luminescence field as possible by covering this part by projection from the start, and realizing higher brightness. Moreover, projection 500 is good to form so that the edge of a reflector 300 may be covered. This is for preventing defect generating of a crack going into the organic film 100 and transparent electrode 200 which are formed on a reflector 300, a transparent electrode 200 being disconnected or a reflector 300 and a transparent electrode 200 short-circuiting with the level difference of the edge of a reflector 300.

[0037]

Projection 500 is formed by carrying out patterning of the insulating ingredient by the photolithography method etc. What is necessary is just to use dielectric materials, such as inorganic substances, such as a silicon oxide and a silicon nitride, or an acrylic, and polyimide, as projection 500. In addition, it is desirable for there to be height of several micrometers or more, in order to realize optical high ejection effectiveness since the height of the inclination reflector 700 and the thickness of a waveguide 600 are decided by this, in order to form the projection of such height for a short time comparatively, as for projection 500, it is realistic to use an organic material, and it is desirable. Projection 500 is carrying out the cross-section configuration to which width of face becomes narrow as it keeps away from a substrate 800, and it serves as an inclined plane where the side face inclined to the substrate side. In addition, as long as projection 500 can form a desired inclined plane, it may be formed by what kind of formation approach, for example, screen printing and the approach of the direct writing by the ink jet may be used for it.

[0038]

The organic layer 100 which has the luminous layer which emits light in red and one of green and blue colors a part of inclined plane of projection 500 and on a reflector 300 is distinguished with predetermined arrangement by island shape for every pixel. The transparent electrode 200 which functions as furthermore covering the whole surface of a display 2 as an anode plate is formed. ITO (Indium Tin Oxide) is [that what is necessary is just to use the transparent high electrode material of a work function as such an electrode] suitable. Moreover, IZO (Indium Zinc Oxide) can also be used.

A transparent electrode 200 is connected with a current supply source line. When a predetermined current is passed between an anode plate (transparent electrode 200) and cathode (reflector 300) as an organic layer 100, the three-tiered structure which carried out the laminating of an electronic transportation layer, a luminous layer, and the hole transportation layer to order from the cathode side, or a luminous layer and an electronic transportation layer can use the two-layer structure made into one layer by using the ingredient which can be made to serve a double purpose that what is necessary is just to use the ingredient which emits light by the desired color.

[0039]

As an ingredient for red luminescence, a hole transportation layer, for example The triphenyl diamine derivative TPD (N, the N'-screw (3-methylphenyl) 1, the 1'-biphenyl -4, 4'-diamine), Alpha-NPD (N, N'-JI (alpha-naphthyl)-N, N'-diphenyl 1, the 1'-biphenyl -4, 4'-diamine), An electronic transportability luminous layer (an electronic transportation layer and a luminous layer are made to serve a double purpose) is DCM-1 (what distributed the 4-(dicyanomethylene)-2-methyl-6-(p-dimethylaminostyryl)-4H-pyran can be used.) to Alq3 (tris (8-KINORINO rate) aluminum).

[0040]

As an ingredient for green luminescence, for example, the hole transportation layer doped the triphenyl diamine derivative TPD, and alpha-NPD and an electronic transportability luminous layer (an electronic transportation layer and a luminous layer are made to serve a double purpose) by Alq3 and Quinacridone. Alq3 and Bebq can be used.

[0041]

As an ingredient for blue luminescence, for example, a hole transportation layer The triphenyl diamine derivative TPD, Alpha-NPD and a luminous layer DPVBi (4 and 4'-bis(2 and 2-diphenyl vinyl) biphenyl), this and BCzVBi (4 and 4'-bis(2-carbazole vinylene) biphenyl) from -- the becoming ingredient -- Or a JISUCHIRIRU ant rain derivative can be made into a host, and Alq3 can be used as what doped the JISUCHIRIRU amine derivative as a guest, and an electronic transportation layer. Moreover, it can consider as an electronic transportability luminous layer (an electronic transportation layer and a luminous layer are made to serve a double purpose), and Zn (oxz)2 (2 -(0-hydroxyphenyl)- zinc complex of benzoxazole) can be used.

[0042]

Furthermore, the ingredient of a polymer system other than the ingredient of the above-mentioned low-molecular system can be used. As an ingredient of a polymer system, they are PEDT/PSS (mixolimnion of Polyethylene dioxythiophene and Polystylene sulphonate), and PPV (the cascade screen of poly (p-phenylene vinylen) can be used as a hole transportation layer and a luminous layer.). Moreover, F8 (Poly (dioctylfluorene)) can be used as that to which green luminescence prepared green ink to PPV, the thing which red luminescence made the rhodamine 101 the red luminescence dopant at green ink, and carried out addition preparation, and a blue luminous layer. In addition, F8 can function as an electronic transportation layer. Moreover, in addition to this as an ingredient of a polymer system, a coloring matter content polymer like PVK (polyvinyl carbazole) can be used. Anyway, each class which constitutes an organic layer 100 consists of films about dozens of nm and below wavelength extent of light.

[0043]

an organic layer 100 -- distinguishing by different color with -- when using the ingredient of a low-molecular system, the patterning membrane formation technique (it indicates to S.Miyaguchi, et al.:"Organic LED Fullcolor Passive-matrix Display", Journal of the SID, 7 and 3, and pp 221-226 (1999)) of the vacuum deposition organic film by the well-known shadow mask can be used. In the case of this process, a shadow mask can dash projection 500 and it can be used as a member. Moreover, when it constitutes an organic layer 100 from an ingredient of a polymer system, a well-known ink jet patterning technique (it indicates to for example, T.Shimada, et al.:"Multicolor Pixel Patterning of Light-Emitting Polymers by Ink-Jet Printing", SID 99 DIGEST, and 376 (1999)) can be used. Projection 500 functions as a bank which separates a pixel field in the case of this process.

[0044]

a transparent electrode 200 top -- it is -- in addition -- and the inclination reflector 700 is formed in the part equivalent to the inclined plane of projection 500. What is necessary is to vapor-deposit or carry out patterning of a metal with a reflection factor high as an inclination reflector 700, for example, aluminum, silver, the chromium, etc. by the photolithography method through a mask, and just to form. In addition, the following effectiveness is also acquired when it constitutes the inclination reflector 700 from a metal membrane. Generally the resistance of a transparent electrode is higher than a metal. For this reason, in a display with a big screen size, it is easy to produce the electrical-potential-difference difference which originated in resistance of an electrode in the location near a power source, and the distant location. It will differ in the location where the current value which flows to the light emitting device (OLED) which constitutes a pixel because of this electrical-potential-difference difference is distant from the location near a power source, and the unevenness of brightness will arise. on the other hand, the inclination reflector allotted the inclination reflector which consists of a metal in the shape of a mesh by carrying out adhesion formation on a transparent electrode -- low -- the role of an electrode [****] is played and the effectiveness that the brightness unevenness resulting from resistance of a transparent electrode can be prevented is acquired.

[0045]

Carrying out the laminating of the transparent dielectrics, such as silicon oxide, silicon nitride, and titanium oxide, in addition to this as an inclination reflector 700, and forming the reflector by multilayers is also considered. In this case, although there is an advantage that a reflector without absorption loss is realizable in case light reflects, the technical problem which should be taken [angular dependence / that creation takes time amount, / of a reflection factor / a wavelength dependency, angular dependence] into consideration occurs. The waveguide 600 which consists of a transparent ingredient to the light is formed in the field of the shape of a depressed ground surrounded in the inclination reflector 700. It is good to use resin transparent as a transparent material with a refractive index lower than a transparent electrode 200 as a waveguide 600.

In this case, after a waveguide 600 carries out liquid-repellency treatment to the inclination reflector 700

which corresponds between pixels, it can be formed by carrying out desiccation solidification of the constituent which consists of a binder resinous principle and a solvent after membrane formation using the forming-membranes methods, such as a spin coat method and the blade coat method. Or the constituent which consists of a binder resinous principle and a solvent may be alternatively formed in the field surrounded by the inclination reflector 700 using printing techniques, such as the ink jet method, by carrying out desiccation solidification after membrane formation.

[0046]

The resin which the binder resin which constitutes a waveguide 600 does not have polymerization reactivity in itself, and only carries out desiccation solidification may be used, and the resin which can be stiffened by the polymerization reaction may be used after membrane formation. When it is resin which can be stiffened by the polymerization reaction, adhesion and endurance are highly made rather than the resin which only carries out desiccation solidification, but since it irradiates in the case of polymerization hardening or it is necessary to heat ultraviolet rays, an electron ray, etc. at it, it is necessary to make it a process to which the damage to the organic film becomes as small as possible. It is important from an above-mentioned reason to be able to use one sort or the thing mixed two or more sorts, a photopolymer, etc. from resin, such as acrylic resin transparent as a waveguide 600, benz-cyclo-butene resin, polyimide resin, an epoxy resin, polyacrylamide, and polyvinyl alcohol, and to make it the thickness H2 of the waveguide 600 after solidification become lower than the height H1 of an inclination reflector.

[0047]

Through a gap 950 in a waveguide 600 top, to the light, it is transparent and the closure member 900 which has gas barrier property is formed. As a closure member 900, a glass plate, the thing which carried out the laminating of the resin film which carried out the laminating of the inorganic material and raised gas barrier nature, and a thin glass plate and a resin film can be used. The closure member 900 secures a gap 950 between waveguides 600 by making projection 500 into a spacer, and fixes it to a substrate 800 by the sealing compound with the adhesive strength formed in the perimeter of a display 2 in the shape of a frame. Under the present circumstances, where inert gas, such as nitrogen, is enclosed with a gap 950, sealing adhesion of the closure member 900 and the substrate 800 is carried out. In addition, it is between the closure member 900 and a substrate 800, and it is good to prepare a drying agent in the location of a display 2 which does not become obstructive if needed.

[0048]

Next, the display action of a display 1 is explained using drawing 8 , drawing 11 , and drawing 12 . Drawing 11 is the timing chart of the electrical potential differences VG1, VG2, ..., VGm by which sequential impression is carried out at the gate lines G1, G2, ..., Gm. Moreover, drawing 12 is the explanatory view of the example of an electrical-potential-difference condition of gate voltage VG1 located in one-line one train, the data electrical potential difference VD1, and storage capacitance 23. The gate lines G1 and G2, the electrical potential differences VG1 and VG2 which carry out the turn-on of the switching transistor 21 to --Gm one by one, and --VGm are impressed as shown in drawing 11 . Time-of-day t=t0 When the electrical potential difference VG 1 which carries out the turn-on of the switching transistor 21 to the gate line G1 is impressed, it is time-of-day t=t0+Tf that finish a vertical scan once within the one-frame period Tf, and a turn-on electrical potential difference is again impressed to the gate line G1. By this drive approach, the time amount by which a turn-on electrical potential difference is impressed to one gate line becomes below Tf/m. Generally as a value of Tf, 1 / about 60 seconds are used.

[0049]

When the turn-on electrical potential difference is impressed to a certain gate line, all the switching transistors connected to the gate line will be in an ON state, and the data electrical potential difference according to a picture signal is impressed to the data lines D1, D2, --, Dn synchronizing with it. This is a method called the so-called line-sequential-scanning method. Next, paying attention to the pixel located in one-line one train, the electrical-potential-difference condition of gate voltage VG1, the data electrical potential difference VD1, and storage capacitance 23 is explained, referring to drawing 12 . t=t0 It sets, the value of the data electrical potential difference VD1 which synchronized with VG1 is set to d1, and the data electrical potential difference in degree frame t=t0+Tf is set to d2. In this case, while the turn-on electrical potential difference is impressed to the gate line G1, these data electrical potential differences are stored in storage capacitance 23, and an one-frame period is mostly maintained at those values. Since the current value which these electrical-potential-difference values specify the gate voltage of the driver transistor 22, and flows a transistor by this is controlled, the fixed current decided by these, the electrical potential difference (fixed) impressed with common potential wiring, and the electrical potential difference Va (fixed)

currently impressed to the transparent electrode flows a light emitting device, and produces predetermined luminescence.

[0050]

That is, synchronizing with a turn-on electrical potential difference being impressed to the gate line corresponding to the pixel which should control the amount of luminescence, the amount of luminescence of a pixel is controllable by impressing the electrical potential difference corresponding to image information through the data line. Therefore, a desired image can be displayed by controlling the amount of luminescence of two or more pixels which constitute a display 2 according to image information. In addition, since the response time after an electrical potential difference is impressed to the both ends of the cathode of a light emitting device and an anode plate until luminescence starts is usually 1 or less microsecond, it can realize image display which can follow in footsteps of the quick image of a motion. Here, generally, although the amount of luminescence will become large and a bright display will be obtained if organic light emitting diode enlarges the current which flows to this, the part power consumption becomes large and the life (for example, time amount until the amount of luminescence becomes half [early]) of a component becomes short.

[0051]

As described above, the display of this invention can use efficiently the light which had been lost by the guided wave as an image light in the former. For this reason, if it is the same power consumption, brightness is high and the display of a bright display can be realized. Or since the current which flows to a light emitting device can be made small if it is the same brightness (brightness), power consumption becomes small and can realize the long display of a life. Furthermore, since the waveguide is separated for every pixel, the light which carries out outgoing radiation from a certain pixel guides waves to other pixel fields, and the display of this invention does not have degradation of the optical cross talk produced by carrying out outgoing radiation from there or an image called a blot of a display, and can realize the high-definition display given distinctly.

[0052]

In addition, although the flat part which is on a substrate 800 and does not have the level difference of a driver element, wiring, etc. was made into the luminescence field and the projection described the wrap case for the level difference of a driver element, wiring, etc. in the above-mentioned example, this invention is not limited to this. That is, the display also including the part in which the level difference of a driver element, wiring, etc. exists is covered in the flattening layer which consists of an insulating material extensively, and you may make it form the structure concerning this inventions, such as a projection formed in the front face by which flattening was carried out a reflector and on it, in the substrate with which a driver element, wiring, etc. were formed. The front face can carry out flattening of these organic materials comparatively easily by forming membranes with a spin coat method etc. that what is necessary is just to use organic materials, such as acrylic resin, benz-cyclo-butene resin, and polyimide system resin, as a flattening layer. Thus, if flattening also of the wiring and driver element top is carried out by the flattening layer and it enables it to use it as a luminescence field, since a large luminescence field can be secured also when wiring and a driver element become large to pixel size and a flat part cannot fully secure, a bright display can be realized.

[0053]

Moreover, although the above-mentioned example explained the display of a active-matrix drive, this invention is not limited to this. That is, you may apply to the display of the passive-matrix drive which links the electrode of the light emitting device of this invention with a vertical-scanning line and a horizontal scanning line directly, respectively, and drives it, without preparing driver elements, such as TFT. Furthermore, arrangement [which], such as stripe arrangement, mosaic arrangement, and delta arrangement, is sufficient as arrangement of a pixel, and it should just choose the suitable arrangement doubled with the specification of a display.

[0054]

Next, the manufacture approach of one example of this invention shown in drawing 1 is explained with reference to drawing 13 thru/or drawing 16 . Drawing 13 is process drawing which manufactures the projection part in the manufacture approach of the display by this invention. As shown in drawing 13 (A), the electrode layer 310 for reflector 300 which consists of aluminum, Mg, a Mg-Ag alloy, or an aluminum-Li alloy is formed on the substrate 800 which a driver element (the following, thin film transistor), wiring, etc. were formed, and formed the insulator layer 890 in the outermost surface further. In addition, a thin film transistor, wiring, etc. have omitted illustration. At this time, the electrode layer 310 of a reflector 300 is

electrically connected with the electrode of the thin film transistor for drivers through the through hole (not shown) formed in the insulator layer 890. Next, a photoresist is applied on the electrode layer 310 for reflector 300, and patterning of the photoresist film is carried out with a photolithography technique. The electrode layer 310 is etched by making this into a protective coat, an unnecessary photoresist is removed, and the island-shape reflector 300 corresponding to a pixel as shown in drawing 13 (B) is obtained.
[0055]
Next, finally a photoresist is applied to desired thickness and thin thickness with a spin coat method etc. on the substrate 800 with which the reflector 300 was formed. Since the photoresist has melted into the solvent at this time, that viscosity is controlled by concentration adjustment etc. and thickness can be controlled by adjusting the rotational speed of the substrate at the time of membrane formation further. The photoresist film 510 is formed by heating and evaporating a solvent after applying a photoresist. The projection 500 formed between pixels as shown in drawing 13 (D) in exposing and (drawing 13 (C)) developing this photoresist film 510 through a photo mask 810 is obtained. In addition, there are a negative mold and a positive type in a photoresist, and when it is a negative mold, since a photoresist begins to melt from the part which is not exposed, a configuration with the cross-section configuration near a rectangle or a trapezoid is easy to be acquired. Moreover, the configuration to which whenever [tilt-angle / of the side face as opposed to a substrate side in the cross-section configuration after development] becomes small continuously as it separates from a substrate is easy to be acquired in the case of a positive type. Selection of these positive types and a negative mold is worn so that that from which the projection of a desired configuration is easy to be obtained in consideration of each property may be chosen, and its **** is good.
[0056]
As a photoresist of a negative mold, the cinnamic-acid system resist which condensed the cinnamic acid which is a sensitization radical, the rubber system resist which added the bis-azide compound as a sensitization radical to cyclized rubber can be used for polyvinyl alcohol. Moreover, as a positive type, the naphthoquinonediazide compound as a sensitization agent and mixture with alkali fusibility phenol resin can be used. As a concrete example of a positive type, there is product name OPUTOMA (product made from JSR). This photoresist is the mixture of acrylic resin and a naphthoquinonediazide compound, for example, in product model name OPUTOMA PC 403, if the rotational frequency of a substrate is formed by 700rpm in a spin coat method, viscosity is adjusted so that thickness of about 3.5 micrometers can be realized.
[0057]
In this case, a photoresist is applied on a substrate and it exposes after heating using the photo mask with which only the part equivalent to a height is exposed. The projection 500 of a configuration which a cross-section configuration illustrates to drawing 14 by developing negatives and heating after exposure is obtained. Whenever [tilt-angle / of a projection side face] becomes small continuously as a 30 to 60 degrees thing is obtained for the include angle beta in a location with whenever [tilt-angle / of the side face of a projection / nearest to a substrate side] according to creation conditions and it separates from a substrate side. For example, when the height of a projection is set to 3.5 micrometer, an include angle beta can acquire a side-face [in which whenever / in height of 3 micrometers / tilt-angle / is about 20 degrees at about 60 degrees] configuration, and it can use as a projection in this example. Moreover, as a positive type photoresist which forms the projection of 3-4 micrometers of thickness, the photosensitive polyimide of product model name HD8010XF2 (Hitachi Chemical make) can also be used.
[0058]
On the transparence substrate which penetrates the ultraviolet rays of a quartz substrate etc., a photo mask 810 should just use that to which pattern formation of the protection-from-light section was carried out by the metal membrane etc. Moreover, in order to control the configuration of the projection finally obtained by changing light exposure delicately with a location, the photo mask to which control of the thickness of a metal membrane or the rate of surface ratio of two or more minute openings was changed with a location, and the effectual permeability of the protection-from-light section was changed continuously may be used. In addition, the case where a photoresist was used as a projection here was described. This is because a projection with a height of several micrometers can be formed by realistic process time amount if a photoresist is used.
[0059]
However, this invention does not eliminate inorganic substances, such as a silicon oxide and a silicon nitride, as a projection. When using a silicon nitride as a projection, the pattern of a photoresist can be formed by the photolithography method on the silicon nitride formed with the CVD method (Chemical Vapor Deposition), and a projection can be formed by removing an unnecessary photoresist after etching. In

addition, NH3 supplied in a membrane formation process SiH4 It is good to control the configuration of the inclined plane of the projection after etching by changing the conditions of concentration and carrying out two or more layer laminating of the silicon nitride from which membraneous quality differs. In addition, as long as projection 500 can form a desired inclined plane, it may be formed by what kind of formation approach, for example, it may use screen printing and the approach of the direct writing by the ink jet.
[0060]
Drawing 15 is process drawing which manufactures the organic film part in the manufacture approach of the display by this invention. The organic film 100 is formed in the field surrounded by a part of inclined plane of projection 500, and the projection 500 on a reflector 300 after forming projection 500 at said process. When the organic film is a low-molecular mold, formation of the organic film 100 is formed in the part equivalent to a luminescence field by vacuum evaporationo through the mask 820 made from a metal plate which has opening, as shown in drawing 15 (A). Under the present circumstances, a mask 820 may dash projection 500 and it may be used as a member. Moreover, when the organic film is a giant-molecule mold, as shown in drawing 15 (B), membranes are formed from the ink jet head 830 by a piezo method etc. with the so-called ink jet patterning technique of spraying the solution which consists of a solvent and an organic film ingredient. In this case, projection 500 can be operated as a bank which collects solutions.
[0061]
After forming the organic film, a transparent electrode 200 is formed all over a display. As a transparent electrode, transparence electric conduction film, such as ITO or IZO, can be used, and membranes can be formed by the vacuum deposition method, the sputtering method, etc. (drawing 15 (C)). However, in the usual vacuum deposition, it is transparent and it difficult to form the small electric conduction film of electric resistance, and in the case of the sputtering method, a damage may be given to the organic film 100, and it may cause performance degradation. For this reason, in case a transparent electrode 200 is formed, it is good [the plasma] to use the ion plating system of the type which cannot touch a substrate 800 directly, or an opposite target mold sputtering system so that a damage may not be given to the organic film 100 as much as possible. Or before forming the transparence electric conduction film directly on the organic film, a transparent electrode may be formed by forming a thin metal membrane to the extent that light is penetrated by vacuum evaporationo, and forming the transparence electric conduction film on this. In this case, since a thin metal membrane functions as a protective layer, the damage to the organic film at the time of transparence electric conduction film formation can be reduced. What is necessary is just to form the high metal of work functions, such as gold, platinum, and chromium, by about 10nm thickness, when making a transparent electrode into an anode plate as this protective coat.
[0062]
Drawing 16 is process drawing which manufactures the waveguide part in the manufacture approach of the display by this invention. As shown in drawing 16 (A), the inclination reflector 700 is formed by vapor-depositing alternatively a metal membrane with high reflection factors, such as aluminum, at a projection using the mask made from a metal plate which has opening into the part equivalent to the projection 500 formed at said process. Then, as shown in drawing 16 (B), the constituent for waveguides is sprayed towards the field of the shape of a depressed ground surrounded by the projection 500 from the ink jet head 850. The constituent for waveguides consists of transparent binder resin to a solvent and the light at least. After making the constituent for waveguides deposit till a place the height of a projection, comparable, or somewhat low, getting used to a transparent electrode 200 or the inclination reflector 700 and fully carrying out leveling, as shown in drawing 16 (16C), the waveguide 600 lower than the height 700 of an inclination reflector is formed by drying and solidifying. In addition, you may make it form a desired waveguide by performing the process of spraying of the constituent for waveguides, desiccation, and solidification two or more times.
[0063]
The resin which the binder resin which constitutes a waveguide 600 does not have polymerization reactivity in itself, and only carries out desiccation solidification may be used, and the resin which can be stiffened by the polymerization reaction may be used after membrane formation. When it is resin which can be stiffened by the polymerization reaction, adhesion and endurance are highly made rather than the resin which only carries out desiccation solidification, but in case it irradiates in the case of polymerization hardening or ultraviolet rays, an electron ray, etc. are heated at it, the damage to the organic film needs to make it the process conditions which become as small as possible. One sort or the thing mixed two or more sorts can be used from resin, such as acrylic resin transparent as a waveguide 600, benz-cyclo-butene resin, polyimide resin, an epoxy resin, polyacrylamide, and polyvinyl alcohol. Moreover, a waveguide with a refractive index

lower than transparent electrodes in constituting a waveguide 600 from such an ingredient, such as ITO and IZO, and a refractive index higher than air can be constituted.

[0064]

In addition, it can form by carrying out desiccation solidification of the constituent for waveguides which consists of a binder resinous principle and a solvent after forming membranes on the whole surface using the forming-membranes methods, such as a spin coat method, besides the approach of using an ink jet technique for the field surrounded by the projection in the constituent for waveguides as the formation approach of a waveguide, and making it deposit on it alternatively. In this case, before forming the constituent for waveguides, it is [after forming an inclination reflector in a projection] good to add the oxygen plasma and the process continuously put to CF4 plasma for a substrate. In this case, it is aluminum about an inclination reflector. If it forms, only the front face of an inclination reflector will be fluorinated by these processings, liquid repellance will come to be shown, and, on the other hand, a transparent electrode will maintain the surface characteristic which is not fluorinated but is easy to get wet to the constituent for waveguides. For this reason, the constituent for waveguides avoids an inclination reflector, and stops at the part which the transparent electrode has exposed, and the waveguide optically separated by the inclination reflector for every pixel can be formed.

[0065]

In addition, although it is desirable for the inclination reflector to dissociate completely as for a waveguide, actually, with a process or an ingredient, it may overcome an inclination reflector and may be connected with the next pixel. In such a case, if the thickness of the waveguide in the field which corresponds on the top of a projection is thinner than the wavelength of light when a waveguide is the field many which becomes the thinnest, the trapped mode of light will be restricted and can make very small light which leaks to the next pixel. For this reason, if it is the case where it is connected by thickness thinner than the wavelength order of light even if the waveguide is connected with the waveguide located in the next pixel, since it can be called the condition of dissociating optically substantially, this invention does not necessarily eliminate this condition.

[0066]

Next, as shown in drawing 1 , the closure member 900 is fixed to a substrate 800 by the sealing compound which has the adhesive strength formed in the perimeter of a display in the shape of a frame where a gap 950 is secured between the closure member 900 and a waveguide 600 by making projection 500 into a spacer. The gap 950 of a refractive index equivalent to air is formed in a gap 950 in the closure member 900 and a substrate 800 by carrying out sealing adhesion of the inert gas, such as nitrogen, in the condition of having enclosed. What is necessary is to be transparent and just to use a thing with gas barrier property to the lights, such as a glass plate and a thing which carried out the laminating of the resin film which performed gas barrier processing, and a thin glass plate and a resin film, as a closure member 900.

[0067]

Next, other examples of the display of this invention are explained. Drawing 17 is the important section sectional view showing the outline of other examples of the display of this invention. This display becomes high continuously as the height H3 of the waveguide 600 of the location equivalent to the center section of the field surrounded by the projection 500 approaches projection 500, except the height H4 of the waveguide 600 on about 700 inclination reflector and the inclination reflector 700 being larger than H3, since the fundamental configuration is the same as the above-mentioned example, the same sign is attached to the same part and detailed explanation is omitted.

[0068]

In case the waveguide 600 which satisfies the relation of such height applies the constituent for waveguides which consists of a binder resinous principle and a solvent, it can be formed by controlling the rate of drying after constituent spreading for waveguides in consideration of the vapor pressure in the boiling point and the ordinary temperature of a solvent. That is, after applying and leveling the constituent for waveguides, if it is made to dry, the volume will decrease with evaporation of a solvent, the center section of the field surrounded by the projection is low, and a waveguide with the high inclination reflector 700 top is obtained. At this time, the front face of a waveguide 600 will be in the condition of it having not been parallel to the substrate side and having inclined.

[0069]

Next, the above-mentioned effectiveness of a waveguide 600 is explained. Drawing 18 and drawing 19 are explanatory views when the outermost surface of a waveguide 600 inclines rather than is parallel to a substrate side, when the height of a waveguide 600 changes with locations. Drawing 18 shows the case

where the height of the waveguide in the right above section of the luminescence location 190 of the light 2100 to which its attention is paid is lower than the height of the waveguide in the location 690 which the light 2100 to which its attention is paid reflects on the surface of a waveguide. In this case, if whenever [over a field parallel to the substrate at the time of light 2100 reflecting on the surface of a waveguide / incident angle], and whenever [angle-of-reflection] are set to theta3 and theta4, respectively, the relation of theta3>theta4 will be realized, and the light reflected on the surface of the waveguide turns into light of the include angle more near parallel to a substrate side. For this reason, since the count which will be reflected with a reflector 300 by the time the light which guides a waveguide reaches an inclination reflector becomes fewer and loss of the light by absorption with a reflector decreases, optical ejection effectiveness improves.

[0070]

On the other hand, drawing 19 shows the case where the height of the waveguide in the right above section of the luminescence location 190 of the light 2100 to which its attention is paid is higher than the height of the waveguide in the location 690 which the light 2100 to which its attention is paid reflects on the surface of a waveguide. In this case, if whenever [over a field parallel to the substrate at the time of light 2100 carrying out total reflection on the surface of a waveguide / incident angle], and whenever [angle-of-reflection] are set to theta3 and theta4, respectively, the relation of theta3<theta4 will be realized, and the light reflected on the surface of the waveguide turns into light of the include angle more near a perpendicular to a substrate side. For this reason, if incidence of the light which carried out total reflection first on the surface of the waveguide is again carried out on the surface of a waveguide after reflecting with a reflector, if it becomes small and it becomes smaller than a critical angle, whenever [that incident angle] does not need to reach an inclination reflector, and can take out light. Therefore, when the outermost surface of a waveguide inclines to a substrate side, optical ejection effectiveness may become high rather than the case where the front face of a waveguide is parallel to a substrate side.

[0071]

Next, other examples of the display of this invention are explained. Drawing 20 is an important section outline sectional view near [explaining other examples of the display by this invention] 1 pixel. Except being the configuration of the shape of a convex lens which becomes thin continuously, since the fundamental configuration is the same as the above-mentioned example, the same sign is attached to the same part and detailed explanation is omitted, as the display of this example has the thickest thickness of a waveguide 600 in the center section of the field surrounded by the projection 500 and projection 500 is approached. The configuration of such a waveguide 600 is good to make the front face of the inclination reflector 700 into liquid repellance, before applying the constituent for waveguides which consists of a binder resinous principle and a solvent, and to make lyophilic the part which the transparent electrode 200 has exposed. Before specifically applying the constituent for waveguides, it is good to add the process which puts a substrate in order of the oxygen plasma and CF4 plasma.

[0072]

In this case, it is aluminum about an inclination reflector. If it forms, only the front face of an inclination reflector will be fluorinated by this processing, ****(water) nature will come to be shown, and, on the other hand, a transparent electrode will maintain the surface characteristic which is not fluorinated but is easy to get wet to the constituent for waveguides. In addition, the transparent wettability adjustable layer which is not illustrated all over a display is applied, an inclination reflector is made into liquid repellance, and it may be made to make the outcrop of a transparent electrode lyophilic alternatively. It can form by a wettability adjustable layer applying the solution which distributed binder resin and a photocatalyst in the solvent with other additives if needed, drying and hardening, and fixing a photocatalyst by resin. Since light will guide this, and a wettability adjustable layer will leak to other pixels and will cause an optical cross talk if it becomes thick, it is desirable to set thickness to 300nm or less using the photocatalyst with which particle size consists of a particle 10nm or less. That what is necessary is just to use organopolysiloxane as titanium oxide and binder resin as a photocatalyst, after such wettability adjustable stratification, an inclination reflector shades, a non-exposed area shows liquid repellance by carrying out mask exposure only of the field which the transparent electrode is exposing and carrying out, and an exposure part comes to show high lyophilic one according to it.

[0073]

Thus, if the constituent for waveguides applies after making the front face of the inclination reflector 700 into liquid repellance and making lyophilic the part which the transparent electrode 200 has exposed, the waveguide of a configuration like a convex lens which becomes thin continuously is realizable as the

location equivalent to the center section of the field surrounded by the inclination reflector, i.e., a projection, from the difference in the contact angle of the inclination reflector formation section and the transparent electrode formation section is the thickest and projection 500 approaches. The improvement effectiveness of the optical ejection effectiveness by the front face of a waveguide 600 inclining to a substrate side also in this example is expectable.

[0074]

Next, other examples of the display of this invention are explained. Drawing 21 is an important section outline sectional view near [explaining other examples of the display by this invention] 1 pixel. In the example explained with reference to drawing 20 , the increase of the thickness of a waveguide and its maximum height of the display of this example are higher than projection 500, since the fundamental configuration is the same as the above-mentioned example, the same sign is attached to the same part and detailed explanation is omitted. In case a wettability adjustable layer is exposed in the case of this example, it can realize by making only the summit section of a projection into liquid repellance, and making a field including the other inclination reflector high lyophilic alternatively by shading only the summit section of a projection. The improvement effectiveness of the optical ejection effectiveness by the front face of a waveguide 600 inclining to a substrate side also in this example is expectable. Moreover, since a waveguide becomes convex lens-like, a display with the high brightness of the direction of a transverse plane is realizable with the condensing effectiveness by the shape of surface type of a waveguide. In this case, especially the projection 500 cannot be used for a substrate 800 and the closure member 900 as a spacer at the time of carrying out sealing adhesion. For this reason, a substrate 800 and the closure member 900 are good to carry out sealing adhesion and to fix, where it applied the sealing compound with the adhesive property which mixed spacer ingredients, such as a bead and a rod, in the perimeter of a display in the shape of a frame and nitrogen is enclosed.

[0075]

Next, other examples of the display of this invention are explained. Drawing 22 is an important section outline sectional view near [explaining other examples of the display by this invention] 1 pixel. In the example explained with reference to drawing 1 , the display of this example loses the closure member 900, and forms the transparent and precise waveguide 650 with still higher gas barrier property (it is hereafter called a gas barrier property waveguide) on a waveguide 600 instead. Since other configurations are the same as the above-mentioned example, the same sign is attached to the same part and detailed explanation is omitted. That what is necessary is just to use inorganic film, such as silicon nitride and titanium oxide, as a gas barrier property waveguide, in case such inorganic film is formed with a CVD method etc., conditions, such as a quantity of gas flow to supply, are optimized, and the most precise possible film is formed. In addition, you may make it constitute a gas barrier property waveguide from two or more layers instead of a monolayer, and it considers as the condition of having dissociated optically for every pixel by applying a photolithography technique etc. if needed further. In this example, like the above-mentioned example, optical ejection effectiveness improves and the display which displays the image without an optical cross talk carried out distinctly can be realized. It is effective in a thinner and lighter display being realizable because there is especially no closure member.

[0076]

Next, other examples of the display of this invention are explained. Drawing 23 is an important section outline sectional view near [explaining other examples of the display by this invention] 1 pixel. Before the display of this example forms the organic film 100 in the example explained with reference to drawing 1 , the inclination reflector 700 which makes the function of a reflector serve a double purpose is formed in a reflector 300 and the inclined plane of projection 500, the organic film 100, a transparent electrode 200, a waveguide 600, etc. are formed on it, the same sign is attached to the part of the same function as the above-mentioned example, and detailed explanation is omitted. The creation approach of the example shown in drawing 23 is explained with reference to the drawing, previous drawing 24 , and previous drawing 25 of an example. In addition, drawing 24 and drawing 25 are process drawings explaining the manufacture approach of other examples shown in drawing 23 of the display by this invention.

[0077]

It is the same as that of said example explained with reference to drawing 13 till the place which forms the island-shape reflector 300 corresponding to the pixel which consists of aluminum, Mg, a Mg-Ag alloy, or an aluminum-Li alloy, and projection 500 on the substrate 800 which a driver element, wiring, etc. were formed and formed the insulator layer 890 in the outermost surface further. Next, as shown on this substrate 800 at drawing 24 (A), the layer which consists of the metallic material of the same reflexibility as a

reflector 300 is formed all over a display, and the island-shape inclination reflector 700 corresponding to a pixel is formed on a reflector 300 and the inclined plane of projection 500 by applying and etching a photolithography technique after that. For this reason, the inclination reflector 700 and a reflector 300 will be in the condition of having connected electrically, and the inclination reflector 700 will function also as a reflector.

[0078]

Next, membranes are formed like the above-mentioned example explained using drawing 15 using the vacuum evaporationo using a mask of the organic film 100, or an ink jet patterning technique. Under the present circumstances, as shown in drawing 24 (B), the organic film 100 is formed in an area larger than the inclination reflector 700 so that the edge of the inclination reflector 700 may be covered completely. This is because it will become the cause of the defect that an inclination reflector connects with the transparent electrode 200 formed on the organic film 100 too hastily if the edge of the inclination reflector 700 is exposed.

[0079]

Next, as shown in drawing 24 (C), a transparent electrode 200 is formed all over a display. It is good to be able to use ITO or IZO like the above-mentioned example as a transparent electrode, and to form membranes by the same approach as the above-mentioned example. Next, as shown in drawing 25 (A), the wettability adjustable layer 210 is applied all over a display if needed. The wettability adjustable layer 210 is a layer which can change a desired field from liquid repellance from lyophilic or lyophilic to liquid repellance alternatively by processing. The film which consists of a photocatalyst and binder resin as a wettability adjustable layer 210 can be used. In this case, a wettability adjustable layer can be formed by applying on a substrate the solution which distributed binder resin and a photocatalyst in the solvent with other additives if needed, drying and hardening, and fixing a photocatalyst by resin. If it becomes thick, light will guide this, and the wettability adjustable layer 210 leaks to other pixels, and causes an optical cross talk. Therefore, it is desirable to make light hard for particle size to set thickness to 300nm or less, using a particle 10nm or less as a photocatalyst, and to guide. As a photocatalyst, organopolysiloxane can be used as titanium oxide and binder resin, in this case, the exposure section comes to show high lyophilic one by exposure processing, and, as for a non-exposed area, it shows liquid repellance.

[0080]

Therefore, as shown in drawing 25 (B), the field which corresponds between pixels, i.e., the summit part of projection 500, shades, and when other parts expose the wettability adjustable layer 210 through the photo mask 870 which penetrates light, the summit part of the projection 500 which corresponds between pixels shows liquid repellance, and other fields come to show high lyophilic one. Next, as shown in drawing 25 (C), the constituent 680 for waveguides is sprayed towards the field of the shape of a depressed ground surrounded by the projection 500 from the ink jet head 880. The constituent for waveguides consists of transparent binder resin to a solvent and the light like the above-mentioned example explained with reference to drawing 16 at least. the until [comparable] deposition of the constituent for waveguides is carried out with the height of the inclination reflector 700. Under the present circumstances, in order that the summit part of projection 500 may show liquid repellance, the sprayed constituent for waveguides avoids the summit part of projection 500, and stops at the depressed ground surrounded by the projection 500 at a part. After fully carrying out leveling of the sprayed constituent for waveguides, by making it dry and solidify, it is lower than the height 700 of an inclination reflector, and the waveguide 600 optically separated for every pixel is formed. In addition, the process of spraying of the constituent for waveguides, desiccation, and solidification is 1. You may make it form the waveguide of a desired configuration not only by the time but by the thing performed two or more times.

[0081]

Next, the closure member 900 is fixed to a substrate 800 by the sealing compound which has the adhesive strength formed in the perimeter of a display in the shape of a frame where a gap 950 is secured between the closure member 900 and a waveguide 600 by making projection 500 into a spacer as shown in drawing 23 . The gap 950 of a refractive index equivalent to air is formed in a gap 950 in the closure member 900 and a substrate 800 by carrying out sealing adhesion of the inert gas, such as nitrogen, in the condition of having enclosed. In order to guide waves in the direction parallel to a substrate side conventionally like the above-mentioned example, and for the light which had been lost to be efficiently led to the inclination reflector 700 by the waveguide 600, and for the travelling direction to change by reflection in the inclination reflector 700 and to be effectively used as an image light also in this example, optical ejection effectiveness improves. Furthermore, since the waveguide 600 is separated for every pixel, waves are guided to the pixel from which

the light which carried out outgoing radiation from the organic layer of a certain pixel differs, and the display which displays a high-definition image without degradation of the image quality of the optical cross talk and optical blot which are produced from there by carrying out outgoing radiation to an observer side can be realized. It functions as a reflector of OLED by which the inclination reflector 700 is further constituted from this example with not a reflector but mere reflector and organic film 100, and a mere transparent electrode 200. For this reason, since not only the flat field 25 but the ramp of projection 500 can be used as a luminescence field, if compared in the same pixel size, a luminescence field larger than the example illustrated to drawing 1 is realizable. For this reason, it is effective in a brighter display being realizable.

[0082]

Drawing 26 is the outline sectional view showing some displays of this example. Also in this example, a reflector 300 and a driver element are connected like the above-mentioned example in the field covered by the projection 500. That is, the electrode 26 and reflector 300 of a driver transistor are connected through the contact hole 31 established in the insulating layer 30, and this contact hole 31 is located under projection 500 and the inclination reflector 700. This is effective in securing as large a luminescence field as possible by arranging the field of the contact hole which cannot be used as a luminescence field under an inclination reflector, and realizing higher brightness.

[0083]

Next, other examples of this invention are explained. Other examples of the display by this invention are the top views showing a field a part, and drawing 27 shows one pixel in the red luminescence pixel which functions as one picture element which displays a predetermined color by additive mixture of colors, a green luminescence pixel, and a blue luminescence pixel. This example is what divided one pixel 20 into two or more fields by the projection 500 accompanied by the inclination reflector 700 in the display of an example explained using drawing 1 and drawing 2 , the same sign is attached to the part of the same function as the above-mentioned example, and detailed explanation is omitted.

[0084]

With the display of this example, one pixel can be divided into two or more fields, and the angle-of-visibility property of brightness can be controlled by changing the relation of the height of luminescence area size and a waveguide 600. This is for the height of the inclination reflector over luminescence area size and the thickness of a waveguide 600 to influence the size of optical ejection effectiveness as above-mentioned. That is, if the die length of the luminescence field to the direction to which its attention is paid is enlarged to the height of an inclination reflector, and the thickness of a waveguide, the optical ejection effectiveness of that direction will become low, if the die length of the luminescence field to the direction which pays its attention to reverse is made small, optical ejection effectiveness will become large and the angle of visibility of the brightness of this direction will spread. Therefore, in the case of the pixel structure of the above-mentioned example illustrated to drawing 2 , the angle of visibility of a longitudinal direction becomes large to the vertical direction on space. On the other hand, at this example shown in drawing 27 , a pixel is divided into plurality and the vertical direction and a longitudinal direction can realize the display of the same angle-of-visibility property by making equal the vertical lay length H3 of each luminescence field and the die length W2 of a longitudinal direction which were divided. Irrespective of the size of a pixel, by dividing a pixel into plurality, since the die length of the luminescence field to the height of an inclination reflector and the thickness of a waveguide can be made shorter than the case where it does not divide, especially at this example, optical ejection effectiveness becomes higher. For this reason, a brighter display is realizable if it is the same power.

[0085]

Drawing 28 is the sectional view which met the C-C line of drawing 27 . Although projection 500 divides one pixel into two or more fields in this example as above-mentioned, it is important in order to control the increment in the defect probability of occurrence by driving by 1 set of driver elements which drive one pixel not complicating a circuit, but the driver element of the field of these plurality increasing. For this reason, a reflector is not separated but the reflector 300 formed in one island shape is formed in one pixel 20. Therefore, the projection 500 which divides a pixel to two or more fields is formed on a reflector 300 as illustration. In this case, since it is connected in respect of being flat, a reflector 300 does not generate the poor open circuit produced for the level difference by projection 500. Moreover, since the laminating of the inclination reflector 700 which functions also as an electrode is carried out on the transparent electrode 200 as above-mentioned, the part into which a transparent electrode 200 overcomes projection 500 changes with the structure which is hard to disconnect.

[0086]
Drawing 29 is an outline sectional view in the C-C line in the case of realizing with the configuration of the example which explained the display shown in drawing 27 with reference to drawing 23 . A reflector is not separated in this case, either, but the reflector 300 formed in one island shape is formed in one pixel 20, and the projection 500 which divides a pixel to two or more fields is formed on a reflector 300 as illustration. Therefore, since it is connected in respect of being flat, a reflector 300 does not generate the poor open circuit produced for the level difference by projection 500. In addition, the configuration of the divided pixel, i.e., the configuration of the field surrounded by projection, is good at any configurations in the configuration from which the angle-of-visibility property of requests, such as polygons, such as three square shapes and six square shapes, and an ellipse, a circle, a semicircle, is acquired outside a rectangle like illustration.
[0087]
Next, other examples of this invention are explained. Drawing 30 is an important section outline sectional view near [explaining other examples of the display by this invention] 1 pixel. The display of this example loses a reflector in the above-mentioned example explained with reference to drawing 23 , it is what was used as the reflector 350 of the inclination reflector combination which shows the inclination reflector 700 in drawing 23 to drawing 30 , and since other configurations are the same as the above-mentioned example, the same sign is attached to the same part and detailed explanation is omitted. In this case, in order to realize a reflector and an inclination reflector in one layer, a process decreases, and productivity goes up by improvement in a throughput. However, if a projection divides one pixel into two or more fields in the case of this structure, it may disconnect, in case a reflector 350 overcomes a projection, and the defect of a pixel that a field does not emit light in part may be generated.
[0088]
This example is the top view showing a field a part, and drawing 31 shows one pixel in the red luminescence pixel which functions as one picture element which displays a predetermined color by additive mixture of colors, a green luminescence pixel, and a blue luminescence pixel. In this example, in the above-mentioned example explained using drawing 27 , the flat field 550 is established in a part of projection which divides a pixel into plurality, and it is characterized by things. Even if a projection is in a pixel by preparing this flat field, it turns to the part in a pixel surely being connected in this flat field. That is, within one pixel, it is connected with one in respect of being flat, without a reflector, the organic film, and a transparent electrode overcoming level differences, such as a projection. Therefore, since connection will be maintained by the flat field also in the structure which an electrode may disconnect in the part which overcomes a projection like the above-mentioned example explained using drawing 30 if this structure is adopted, it is hard to generate the defect in a pixel that a field does not emit light in part. That is, defect generating by open circuit of an electrode is controlled by establishing a flat field in a part of projection, and the yield improves.
[0089]
Next, other examples of this invention are explained. Drawing 32 is an important section outline sectional view near [explaining other examples of the display by this invention] 1 pixel. In the example which explained the display of this example using drawing 1 A red luminescence pixel, All of a green luminescence pixel, a blue luminescence pixel, and the organic layer distinguished by different color with are used as the organic layer of blue luminescence. It is what prepared the color conversion layer which emits red fluorescence in response to a blue light, and the color conversion layer which emits green fluorescence in response to a blue light into the waveguide of the location equivalent to the pixel which displays red and green, respectively, and the same sign is attached to the part of the same function as the above-mentioned example, and detailed explanation is omitted. Here, it is related with full color-ization of an OLED display, and the method of shoes is proposed and proved, it gets down, and there is a method (the henceforth, CCM method) which combined the blue light emitting device and the color conversion layer (CCM:color changing mediums) of fluorescence with one of them. The CCM method excites the fluorescence pigment layer for color conversion of fluorescence with the light generated in the blue luminous layer, changes it into green and red from blue, and obtains three-primary-colors luminescence (information image media society magazine Vol.54, No8, 1115 to pp1120 reference).
[0090]
this example is what applied the CCM method to the display concerning this invention, and about a blue luminescence pixel, like the above-mentioned example, a waveguide comes out further, forms, and as red and a green luminescence pixel are shown in drawing 32 , it carries out laminating formation of the first

waveguide 601, the color conversion layer 602, and the 2nd waveguide 603 at this order to the field of the shape of a depressed ground surrounded by projection 500. As for the 1st waveguide and 2nd waveguide, it is [that what is necessary is just to constitute from transparent inorganic substances, such as transparent resin or transparent silicon nitride, silicon oxide, and titanium oxide, / the refractive index of the 1st waveguide 601] desirable to make it higher than the refractive index of a transparent electrode 200. It is because carry out outgoing radiation of this from an organic layer 100 when the refractive index of the 1st waveguide 601 is higher than the refractive index of a transparent electrode 200, and carrying out total reflection of the light which passes a transparent electrode 200 in the interface of the 1st waveguide 601 and a transparent electrode 200 is lost, and it is efficiently led to the color conversion layer 602, so the light changed into a desired color in a color conversion layer increases and optical ejection effectiveness improves. Titanium oxide can be used as a waveguide ingredient with a refractive index higher than the transparent electrode which consists of ITO, IZO, etc.

[0091]

It is important for the height of a color conversion layer and the 2nd waveguide to make it lower than the height of an inclination reflector. In this case, among the light emitted from the color conversion layer 602, to a substrate side, the light emitted at an include angle near in parallel guides a waveguide, and since that part goes to an observer 1000 side as an image light by reflecting in an inclination reflector, optical ejection effectiveness improves. The light furthermore emitted from the color conversion layer 602 leaks to other pixels, and the high-definition display without degradation of the optical cross talk produced by carrying out outgoing radiation from there to an observer 1000 side or the image quality of a blot of a display given distinctly can be realized. In addition, although effectiveness, such as improvement in effectiveness, is acquired even if the 2nd waveguide 603 does not have this, it is important to surely form the gap 950 where a refractive index is equivalent to air between a color conversion layer and a closure member in that case. It is because a cross talk and the problem of a blot are caused by a part of light emitted from the color conversion layer guiding the inside of a closure member, being lost or this carrying out incidence to another pixel through the closure member 900, when not preparing a gap, and carrying out outgoing radiation from there to an observer 1000 side.

[0092]

Next, other examples of the display of this invention are explained. In the above-mentioned example which explained the example explained here using drawing 1 , drawing 2 , etc. All the organic layers distinguished by different color by the red luminescence pixel, the green luminescence pixel, and the blue luminescence pixel with are used as the organic layer of white luminescence. It is what carried out mixing distribution of the red pigment at the waveguide of the location equivalent to a red display pixel, carried out mixing distribution of the green pigment at the waveguide of the location equivalent to a green display pixel, and carried out mixing distribution of the blue pigment at the waveguide of the location equivalent to a blue display pixel. Detailed explanation is omitted about the part of the same function as the above-mentioned example.

[0093]

There are a configuration which carries out the laminating of two or more luminous layers from which the luminescent color differs as an organic layer which realizes white luminescence, and a configuration which dopes the coloring matter with which the luminescent color differs in one luminous layer. As a former configuration, Alq3 of TPD and Alq3 is partially doped in the Nile red, and there are some which combined further 1, 2, and 4-triazole derivative (TAZ). Moreover, as the latter, it is 3 to PVK. The coloring matter, 1, 1, and 4, of a class, 4-tetra-phenyl - 1 Three - There are some which doped a butadiene (TPB), a coumarin 6, and DCM1. [for example,] Anyway, as an organic layer of white luminescence, luminous efficiency is high, and it is desirable to use that from which long white luminescence of a life is obtained.

[0094]

Like the example explained with reference to drawing 16 , a waveguide can be formed by spraying the constituent for waveguides towards the field of the shape of a depressed ground surrounded by the projection 500 from the ink jet head 850, as shown in drawing 16 (B). In this example, the constituent for waveguides contains the pigment other than a solvent and transparent binder resin. The pigment contained in the constituent for waveguides mixes a blue pigment in green pigments and the constituent for waveguides sprayed on a blue display pixel, and distributes to it at the constituent for waveguides sprayed on a red display pixel at red pigments and the constituent for waveguides sprayed on a green display pixel. A pigment should just use the same thing as the pigment for color filters used for a liquid crystal display.

[0095]

Although the light of the wavelength equivalent to red penetrates in the waveguide corresponding to a red display pixel although incidence of the white light which carried out outgoing radiation from the organic layer is carried out to a waveguide in this example after reflecting with direct or a reflector since the pigment of a desired color is contained in a waveguide, respectively for example, most light of the other wavelength is absorbed. For this reason, after penetrating a waveguide, or guiding a waveguide and reflecting in an inclination reflector, if the light which turns on an observer is a red display pixel, it will turn into a red light. The light of a desired color carries out outgoing radiation similarly about green or other color specification pixels of being blue. Since the number of the organic layers needed in this example is one and there is no need of distinguishing by different color with for every pixel, nothing, it has the features that manufacture is easy. Moreover, like the above-mentioned example, while optical ejection effectiveness improves according to an operation of a waveguide and an inclination reflector, the high-definition display without an optical cross talk carried out distinctly is realizable.

[0096]

Although the case of the so-called active-matrix type which displays by controlling luminescence actuation of the organic light emitting diode which constitutes two or more pixels arranged in the shape of a matrix from an example described until now by the driver element of display was explained, this invention is not limited to this. That is, the structure which improves the optical ejection effectiveness of above-mentioned this invention is applied also to the so-called passive matrix type of display, and the light source of a mere lighting system etc. Moreover, about a light emitting device, light will be emitted in media with a refractive index higher than air, such as not only above-mentioned organic light emitting diode but an inorganic electroluminescent element, inorganic light emitting diode, etc., and it will be clear from the above that a part of luminous layer [at least] is effective to a flat thing.

[0097]

[Effect of the Invention]

As explained above, according to this invention, optical ejection effectiveness improves according to an operation of a waveguide and an inclination reflector, if it is the same power consumption, brightness is more high and the display of a bright display can be realized. Moreover, since the current which flows to a light emitting device can be made small if it is the same brightness (brightness), power consumption becomes small and it is effective in a display with a still longer life being realizable. Furthermore, the display with which the high-definition display without a blot of an optical cross talk and a display given distinctly is obtained can be offered.

[Brief Description of the Drawings]

[Drawing 1] It is an important section outline sectional view near [explaining one example of the display by this invention] 1 pixel.

[Drawing 2] It is an important section top view explaining one example of the display by this invention.

[Drawing 3] It is an important section outline sectional view for explaining an example of actuation of one example of the display by this invention.

[Drawing 4] It is an explanatory view by the graph which shows the result of having estimated the relation of the angle-of-visibility property of alpha and brightness whenever [tilt-angle].

[Drawing 5] It is the explanatory view of the effectiveness by the size relation between a waveguide when the refractive index of a waveguide is smaller than the refractive index of a transparent electrode, and the refractive index of a transparent electrode.

[Drawing 6] It is the explanatory view of the effectiveness by the size relation between a waveguide when the refractive index of a waveguide is larger than the refractive index of a transparent electrode, and the refractive index of a transparent electrode.

[Drawing 7] It is the block diagram showing typically the whole one example layout of the indicating equipment by this invention.

[Drawing 8] It is the representative circuit schematic of the active matrix constituted by the display of drawing 7 .

[Drawing 9] It is the important section outline perspective drawing of the planar structure of the pixel in one example of the display by this invention.

[Drawing 10] It is the sectional view which met the B-B line of drawing 9 .

[Drawing 11] It is the timing chart of the electrical potential difference by which sequential impression is carried out at a gate line.

[Drawing 12] It is the explanatory view of the gate voltage located in one-line one train, a data electrical potential difference, and the example of an electrical-potential-difference condition of storage capacitance.

[Drawing 13] It is process drawing which manufactures the projection part in the manufacture approach of the display by this invention.
[Drawing 14] It is the explanatory view of a projection part.
[Drawing 15] It is process drawing which manufactures the organic film part in the manufacture approach of the display by this invention.
[Drawing 16] It is process drawing which manufactures the waveguide part in the manufacture approach of the display by this invention.
[Drawing 17] It is the important section sectional view showing the outline of other examples of the display of this invention.
[Drawing 18] It is the explanatory view of the effectiveness of a waveguide.
[Drawing 19] It is the explanatory view of the effectiveness of a waveguide.
[Drawing 20] It is an important section outline sectional view near [explaining other examples of the display by this invention] 1 pixel.
[Drawing 21] It is an important section outline sectional view near [explaining other examples of the display by this invention] 1 pixel.
[Drawing 22] It is an important section outline sectional view near [explaining other examples of the display by this invention] 1 pixel.
[Drawing 23] It is an important section outline sectional view near [explaining other examples of the display by this invention] 1 pixel.
[Drawing 24] It is process drawing explaining the manufacture approach of other examples shown in drawing 23 of the display by this invention.
[Drawing 25] It is process drawing explaining the manufacture approach of other examples shown in drawing 23 of the display by this invention.
[Drawing 26] It is the outline sectional view showing a part of other examples of the display by this invention.
[Drawing 27] It is the top view of other examples of the display by this invention showing a field in part.
[Drawing 28] It is the sectional view which met the C-C line of drawing 27 .
[Drawing 29] It is an outline sectional view in the C-C line in the case of realizing with the configuration of the example which explained the display shown in drawing 27 with reference to drawing 23 .
[Drawing 30] It is an important section outline sectional view near [explaining other examples of the display by this invention] 1 pixel.
[Drawing 31] It is the top view of other examples of the display by this invention showing a field in part.
[Drawing 32] It is an important section outline sectional view near [explaining other examples of the display by this invention] 1 pixel.
[Drawing 33] It is an important section outline sectional view explaining an example and the display action of the structure of the conventional OLED.
[Drawing 34] It is the important section outline sectional view showing an example of the conventional OLED.
[Description of Notations]
1 .... An indicating equipment, 2 .... A display, 3 .... Data drive circuit, 4 .... A scan drive circuit, 7 .... The data line, 8 .... Gate line, 20, 20R, 20G, 20B .... A pixel, 21 .... Switch transistor (thin film transistor for switching), 22 .... A driver transistor (thin film transistor for a drive), 23 .... Storage capacitance, 24 [.... A reflector, 500 / .... A projection, 600 601, 602 / .... A waveguide, 700 / .... An inclination reflector, 800 / .... A substrate, 900 / .... A closure member, 950 / .... Gap.] .... A light emitting device, 100 .... The organic film, 200 .... A transparent electrode, 300

[Translation done.]

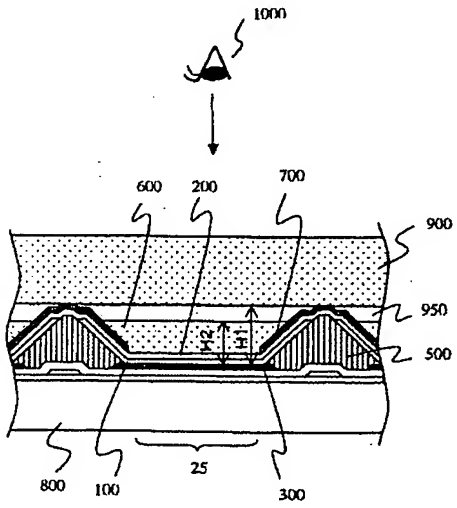
* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

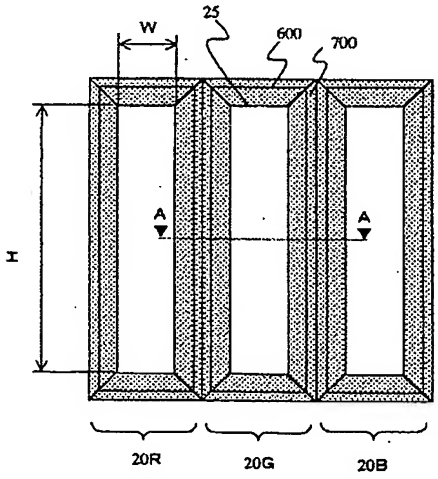
[Drawing 1]

図 1



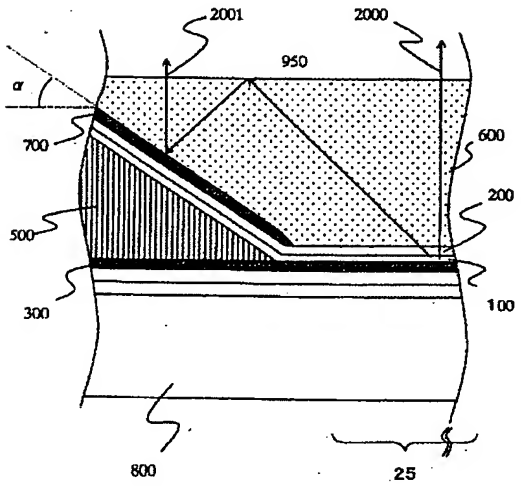
[Drawing 2]

図 2



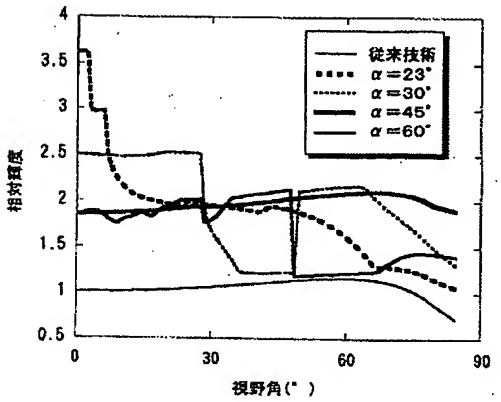
[Drawing 3]

図 3



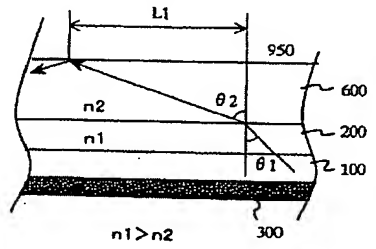
[Drawing 4]

図 4



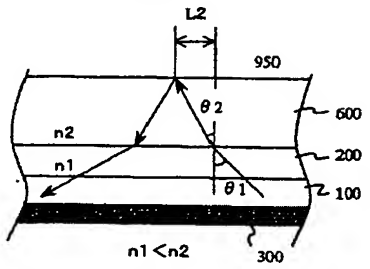
[Drawing 5]

図 5



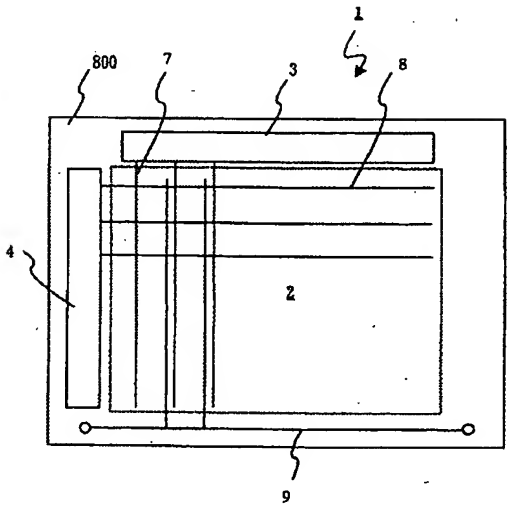
[Drawing 6]

図 6



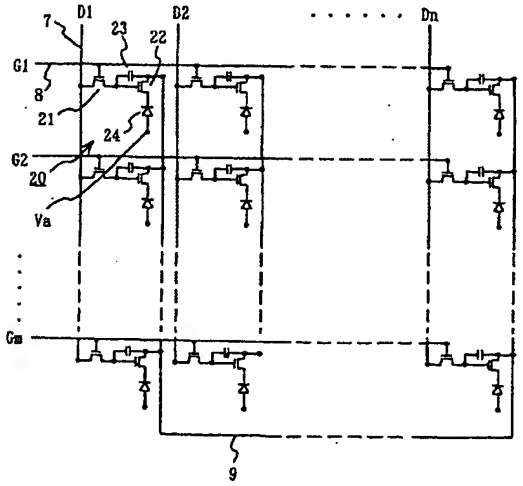
[Drawing 7]

図 7



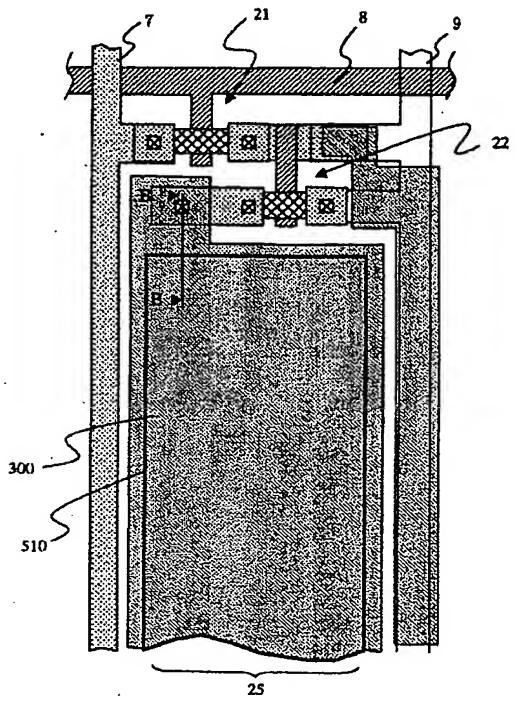
[Drawing 8]

図 8



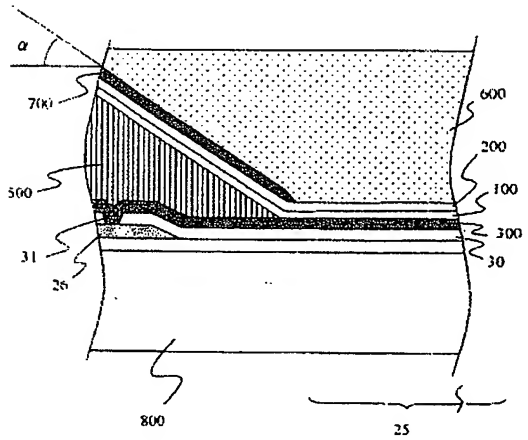
[Drawing 9]

図 9



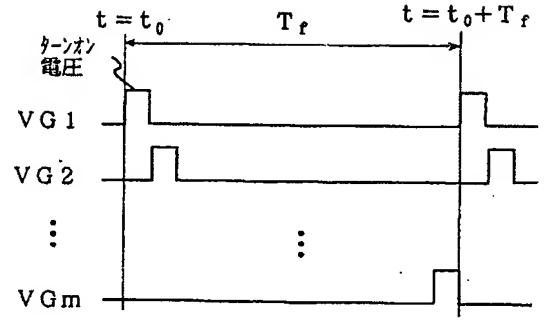
[Drawing 10]

図 10



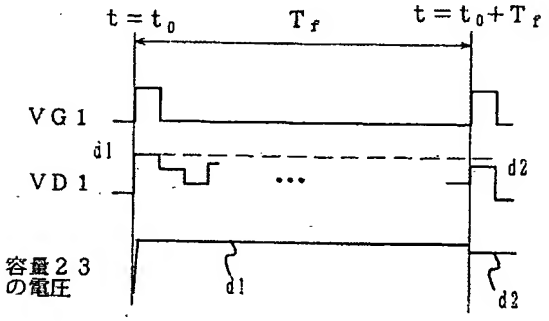
[Drawing 11]

図 11



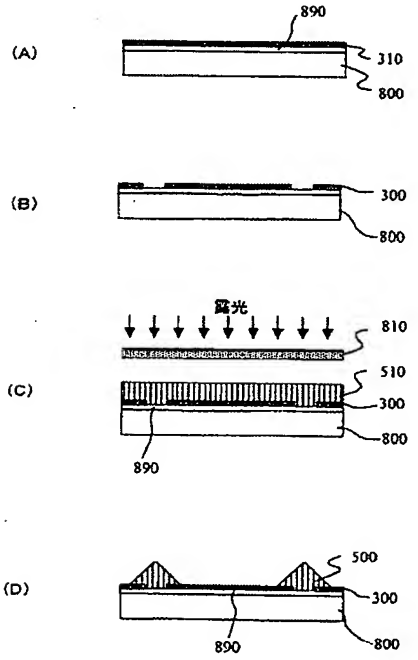
[Drawing 12]

図 12



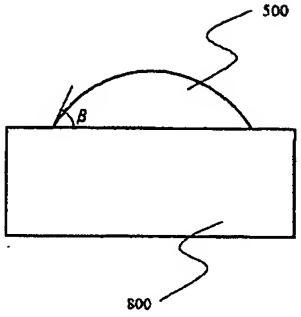
[Drawing 13]

図 13



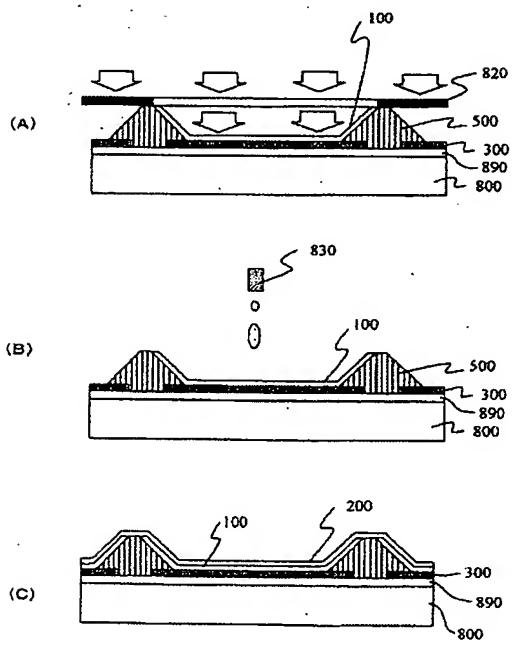
[Drawing 14]

図 14



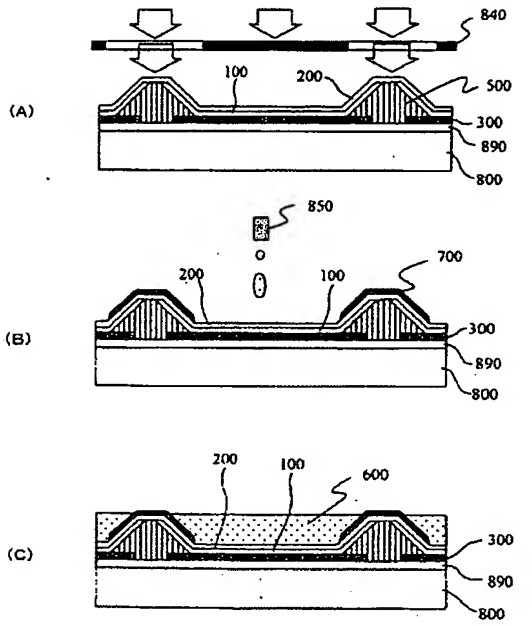
[Drawing 15]

図 15



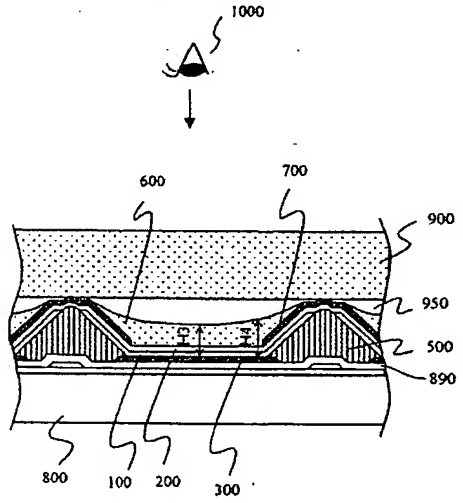
[Drawing 16]

図 16



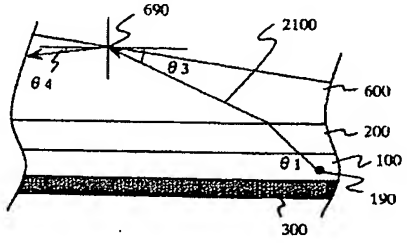
[Drawing 17]

図 17



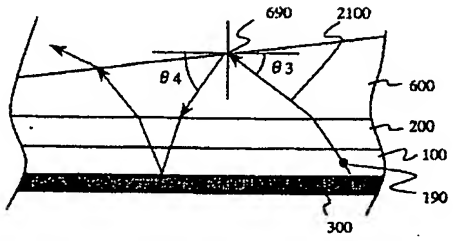
[Drawing 18]

図 18



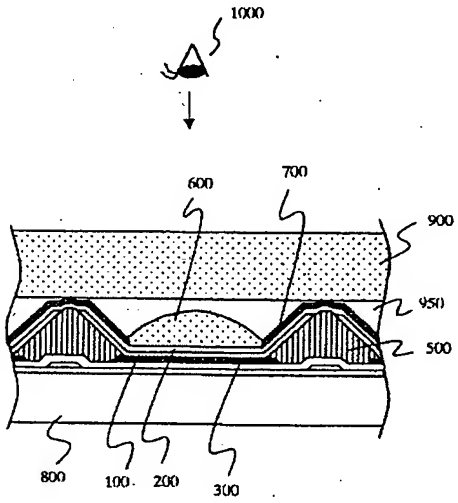
[Drawing 19]

図 19



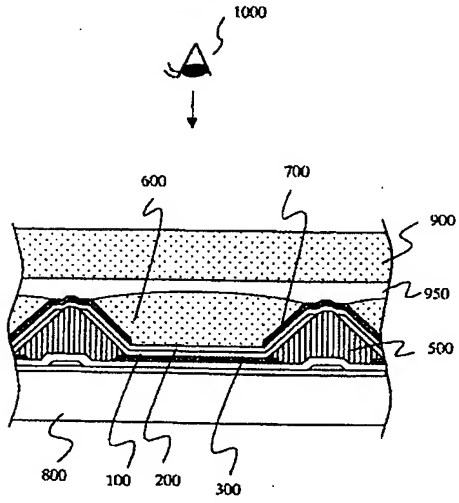
[Drawing 20]

図 20



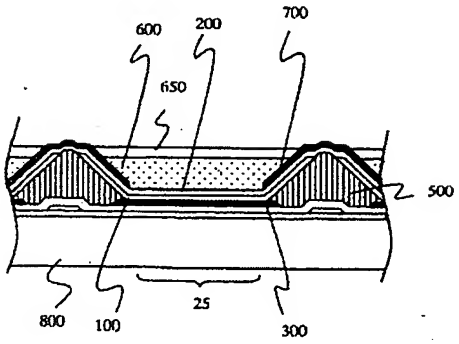
[Drawing 21]

図 21



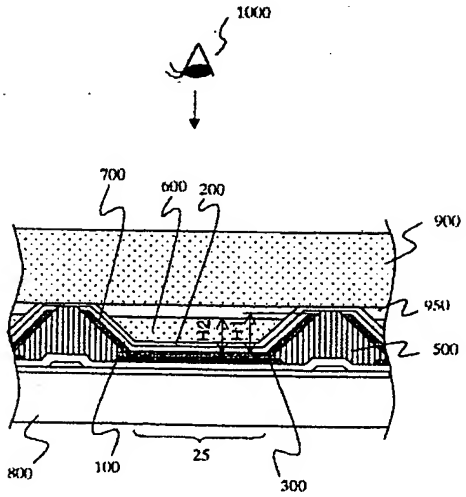
[Drawing 22]

図 22



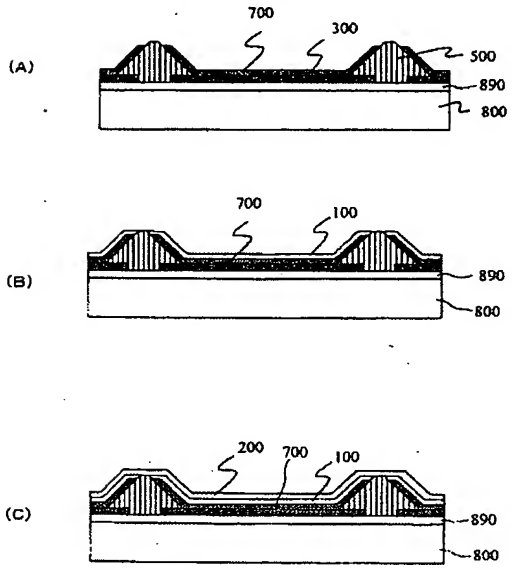
[Drawing 23]

図 23



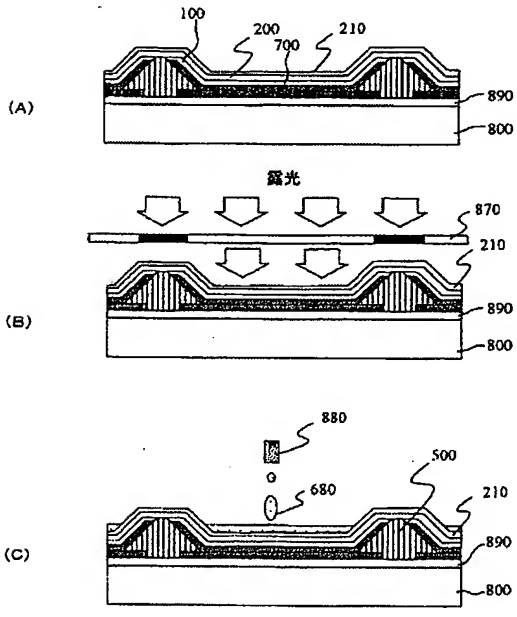
[Drawing 24]

図 24



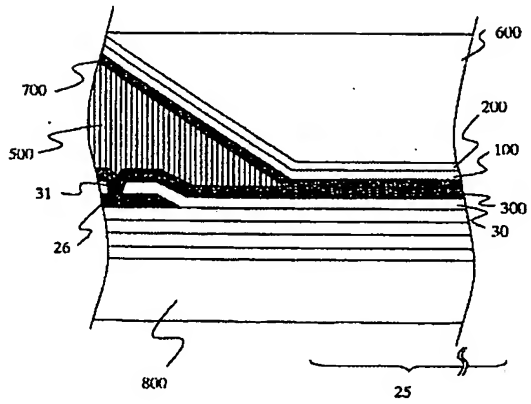
[Drawing 25]

図 25



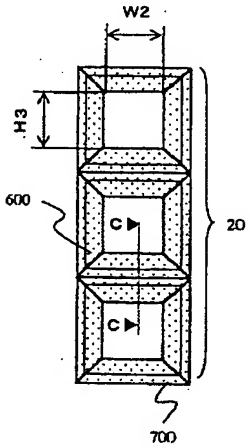
[Drawing 26]

図 26



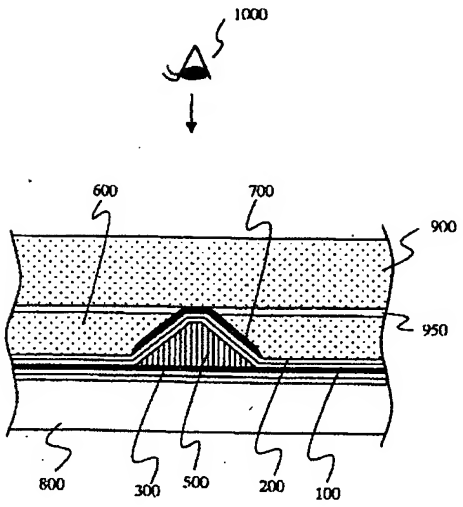
[Drawing 27]

図 27



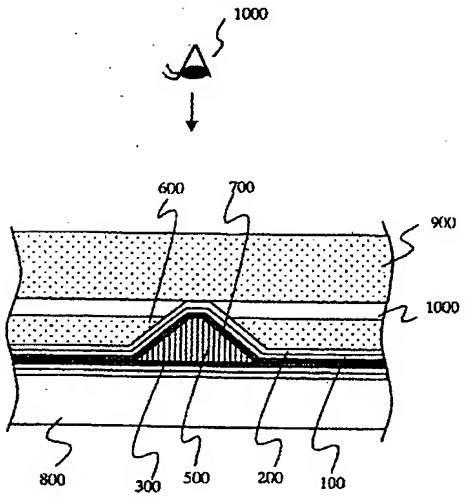
[Drawing 28]

図 28



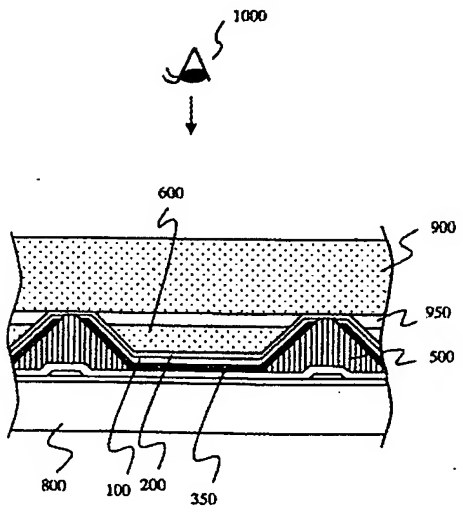
[Drawing 29]

図 29



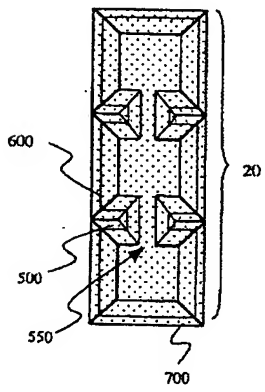
[Drawing 30]

図 30



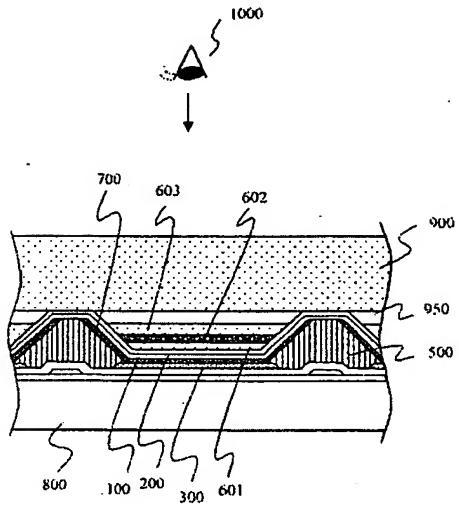
[Drawing 31]

図 31



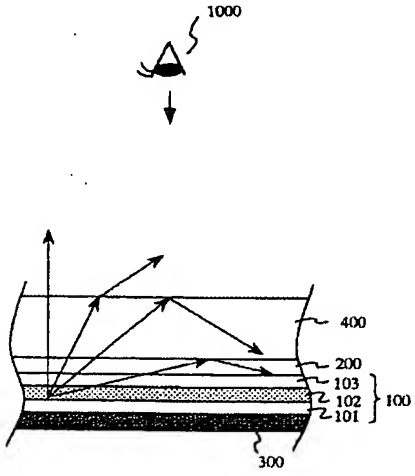
[Drawing 32]

図 32



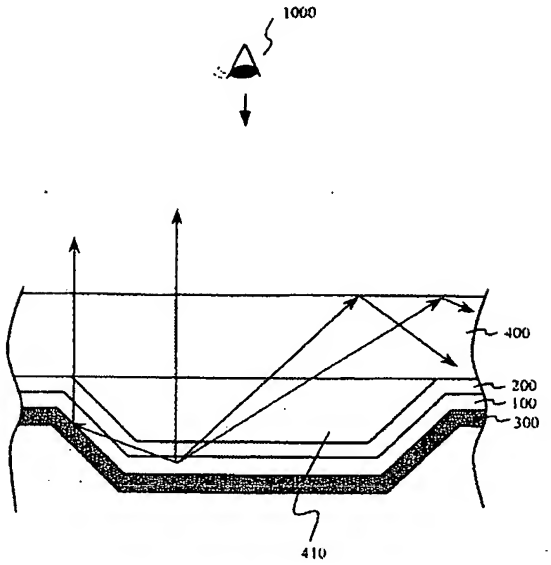
[Drawing 33]

図 33



[Drawing 34]

図 34



[Translation done.]